SIEMENS

Add 7
AddFEM (Front End Module)

Manual Edition 07/2005

SIEMENS

Add 7

AddFEM
Front End Module

Manual

A5E00075541C-05

Safety information

This manual contains notices intended to ensure personal safety (highlighted by a warning triangle), as well as to protect the products and connected equipment against damage (text without warning triangle.) The texts shown below are graded according to severity.

Danger

indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken

Warning

indicates that death, severe personal injury or substantial property damage **may** result if proper precautions are not taken.

Caution

text with warning triangle warns of the risk of minor personal injury if proper precautions are not taken.

Caution

text without warning triangle warns of the risk of damage if proper precautions are not taken.

Notice

warns of the risk of unwanted events being triggered or of the development of indefinite states if the corresponding notice is ignored.

With several risk levels the warning with the highest risk level applies. A warning of the risk of personal injury which is highlighted by a warning triangle may also contain an additional warning of the risk of damage.

Qualified personnel

The devices / system should always be commissioned and operated in accordance with this documentation. Only **qualified personnel** should be allowed to install and use this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with current safety standards.

Use as intended

Please note:

Warning

This device and its components may only be used for the applications described in the catalog or technical description and only in combination with devices or components from other manufacturers which have been approved or recommended by Siemens. This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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Preface

Product family Add 7

The Add-on products of the Add 7 product family provide a cost-effective solution for the specific high-performance requirements in the field of process control and automation engineering. The design of these products is based on many years of experience in the field of process engineering, and on solid expertise with respect to the current system generation in the Siemens “Totally Integrated Automation“ program.

As part of the Add 7 product family, the AddFEM Front End Module satisfies the special requirements of high-speed turbine control systems (different signal types, redundancy, high-speed detection and signal preparation etc.)

Expansions

6DL3100-8AC offers the option of operating the AddFEM in redundant mode (module redundancy), and/or to process signal preparation functions on the AddFEM.

The AddFEM 6DL3100-8AC can be programmed in RUN using DPV1 services.

Further support

If you have any questions about the use of the products described in this manual and do not find the right answers, please contact your Siemens partner AT YOUR LOCAL Siemens Office or Agencies.

CE Label

Our products are compliant with EC Directive 89/336/EEC “Electromagnetic Compatibility, EC Directive 73/23/EEC “Low-voltage Directive”, and the European Harmonized Standards specified in those directives).

CE

In accordance with the above stated directives, the EC Declaration of Conformity is available to the responsible authorities at:

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A&D SE S2
Siemensallee 84
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Chapter overview

1.1 Classification and features

The add-on products of the Add 7 product family provide solutions for specific and high-performance applications in the field of process control and automation engineering.

The Front End Module of the Add 7 product family is tailored to the special requirements of high-speed turbine control systems (different signal types, redundancy, high-speed acquisition and preparation of process data, etc.) AddFEM supports the implementation of loop control systems in the gas-, steam- and water-driven and industrial turbines sector. The AddFEM is also suitable for integrated automation and loop control applications where the emphasis is set on high-speed system reaction times.

The AddFEM offers highly versatile combination options. It supports integration in SIMATIC S7 and SIMATIC PCS 7 systems, and in SPPA-T3000 or SIMADYN D. The AddFEM operates in DP standard slave mode, and is controlled via PROFIBUS DP. The loop control and automation functions are handled as usual by the automation processor.

Signal I/Os

The AddFEM is equipped with analog and digital IOs, including counter inputs for the acquisition of velocity control data.
Due to the optimized composition of signals, and based on an organization by the various signal types, smaller applications can be easily handled by a single AddFEM module. More complex applications, of course, can be handled by integrating several modules.

AddFEM signal IOs for the various signal types:

- 12 analog inputs, of which six may be operated as current inputs, while the remaining six may be configured in SIMATIC Manager or COM-PROFIBUS for operation as current or voltage inputs
- 8 analog outputs
- 15 digital inputs, of which three are available as counting pulse inputs for the acquisition of velocity control data with and without detection of the rotational direction
- 16 digital outputs, optionally operable as digital inputs

Due to the design of its analog IO measuring ranges, the AddFEM does not require any additional signal transducers when operated in turbine loop control systems. In addition to the usual measuring ranges 0 mA to 20 mA, 4 mA to 20 mA and ±20 mA, the module provides a ±30 mA measuring range. An additional ±50 mA measuring range at the analog outputs supports the control of final control elements with higher current consumption, such as fuel control valves, without additional signal amplifier.

All analog and digital outputs are short circuit-proof and monitored, and can be wired in parallel with other outputs. The analog and digital circuits are electrically isolated.

For further technical data of the IO, refer to chapter 4.

Higher availability due to redundancy

Redundancy in this context refers to the integration of a "1 of 2" structure. Availability is enhanced by means of parallel operation of two AddFEM modules. If one AddFEM fails as a result of error, the standby module automatically takes over the functions.

Redundancy of an AddFEM 6DL3100-8AA is controlled by the integrated functions in the automation processor configuration. In contrast, this redundancy control is integrated in the system performance of an AddFEM 6DL3100-8AB/-8AC. The redundancy coupling function on this module is implemented by a fiber optic interface which is used to transfer the status and update data. The extensive, integrated redundancy mechanisms and self-diagnostics functions of AddFEM support automatic error detection and redundant changeover, without any user intervention.

Redundant PROFIBUS DP connection

The AddFEM is equipped with two PROFIBUS DP interfaces (DP A and DP B) which operate in parallel which support the implementation of redundant system structures. All process input data are routed to both PROFIBUS DP interfaces, whereas only the process output data of the currently active DP interface are passed to the output pins. The process output data of the currently passive DP interface are analyzed for the purpose of monitoring. The master standby status of both DP interfaces, i.e. the definition of which DP interface is active or passive with respect to the output data can be set by the automation processor.

Preparation functions

Certain partial automation functions, such as the position control of turbine loop control circuits, can be swapped to the AddFEM as preparation functions. These functions are referred to as Front-End-Function (FEF.)

GSD file

The PROFIBUS DP parameters and properties of the IO (measuring ranges, filtering, for example) of an AddFEM operated on SIMATIC S7 and SIMATIC PCS 7 systems can be set in SIMATIC Manager using HW Config. When operated on a SIMADYN-D system, the corresponding settings are programmed using the COM-PROFIBUS software package.

For information on using the GSD file, refer to the “readme.pdf“ on your AddFEM CD.

Module power supply

The AddFEM power supply is designed to operate at a rated voltage of 24 V DC, and at a typical current consumption of 20 W. Voltage dips with a duration of up to

10 ms are buffered. The inrush current is limited to 3 A.
The AddFEM is equipped with an internal 24 V DC power supply for the analog outputs. The 24 V DC load voltage for the digital outputs must be generated by an external power supply which is wired to the X7 connectors.

Design

The AddFEM enclosure is made of stainless steel, and is prepared for screw-mounting or rail mounting.

The signal state of the digital IO is indicated by signal LEDs.

The operating and error states of AddFEM are indicated at 12 separate LEDs. The mode of operation is set by means of a key switch and slider.

The AddFEM front panel features eight 10-pin connectors (total of 80 IO pins) for the connection of process IO signals.

Certifications

In addition to the CE label, the AddFEM is also certified to UL/CSA.

1.1.1 Variant 6DL3100-8AC, fields of application

The enhanced DPV1 services of AddFEM are in particular suitable to provide dynamic parameter data (in acyclic mode) to the Front-End-Functions (FEF.) These enhanced functions also support configuration changes in Run (= CiR = Configuration in RUN). CiR lets you reconfigure AddFEM parameters, such as enabling unused channels, or editing the parameters of active channels when using sensors with different technical data. The functionality also includes an option of reporting alarms with implicit acknowledgment mechanism for use by the Front-End-Functions.

PROFIBUS DPV1

Variant 6DL3100-8AC (DPV1 slave) supports DPV1 services to IEC 61158 part 3-6. The DP master, of course, also has to meet those requirements (refer to the DP master documentation.)

PROFIBUS DPV2

Variant 6DL3100-8AC supports the PrmCommand to PROFIBUS Guideline 2.212 for the changeover of communications redundancy (changeover between DPV1 channels A and B), and provides redundancy status data for diagnostics functions.

The table below shows the new functions of the AddFEM DPV1 slave:

Function	DPV0 slave 6DL3100-8AA/-8AB	DPV1 slave 6DL3100-8AC	Comment
Cyclic data exchange	X	**X**	
Ayclic data exchange (read/write data record) DP master class 1 services (parameter assignment master) DP master class 2 services are not supported (SIMATIC PDM, for example)	-	**X**	Programming the AddFEM in RUN. Usefulf in particular to supply the Front-End-Function with parameter values.
Diagnostics			
device-specific diagnostics	**X**	-	
ID-specific diagnostics	-	**X**	One alarm can be reported per diagnostics frame.
module status	-	**X**	
Channel-specific diagnostics	-	**X**	

Function	DPV0 slave 6DL3100-8AA/-8AB	DPV1 slave 6DL3100-8AC	Comment
Alarms · Diagnostics alarm · manufacturer-specific alarm	 - -	 X X	 Supports DS0/DS1. This alarm is available to Front-End-Functions.
Redundancy changeover Changeover of communication redundancy between DPV1 channels A and B.	-	X	Changeover using the PrmCommand, and reporting of the redundancy state as diagnostics data.

For further information about the configuration in the host system, refer to the relevant FEF manual. The FEF manuals are included on the AddFEM CD, in the folder of the corresponding order number.

1.1.2 Driver blocks

Depending on the automation processor used, you can control the AddFEM using the driver blocks, or, for example in turbine applications with SYMADYN-D, directly in the user program by means of PROFIBUS user frames.

Driver blocks for SIMATIC S7 are available at

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Configuration

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Chapter overview

2.1 AddFEM configuration

The stainless steel enclosure of the AddFEM accommodates the power supply, processors, PROFIBUS DP interfaces, interfaces for process IO signals, redundancy and service interface (fiber optic system), switches and status displays.

All connecting elements are protected with labeled covers.

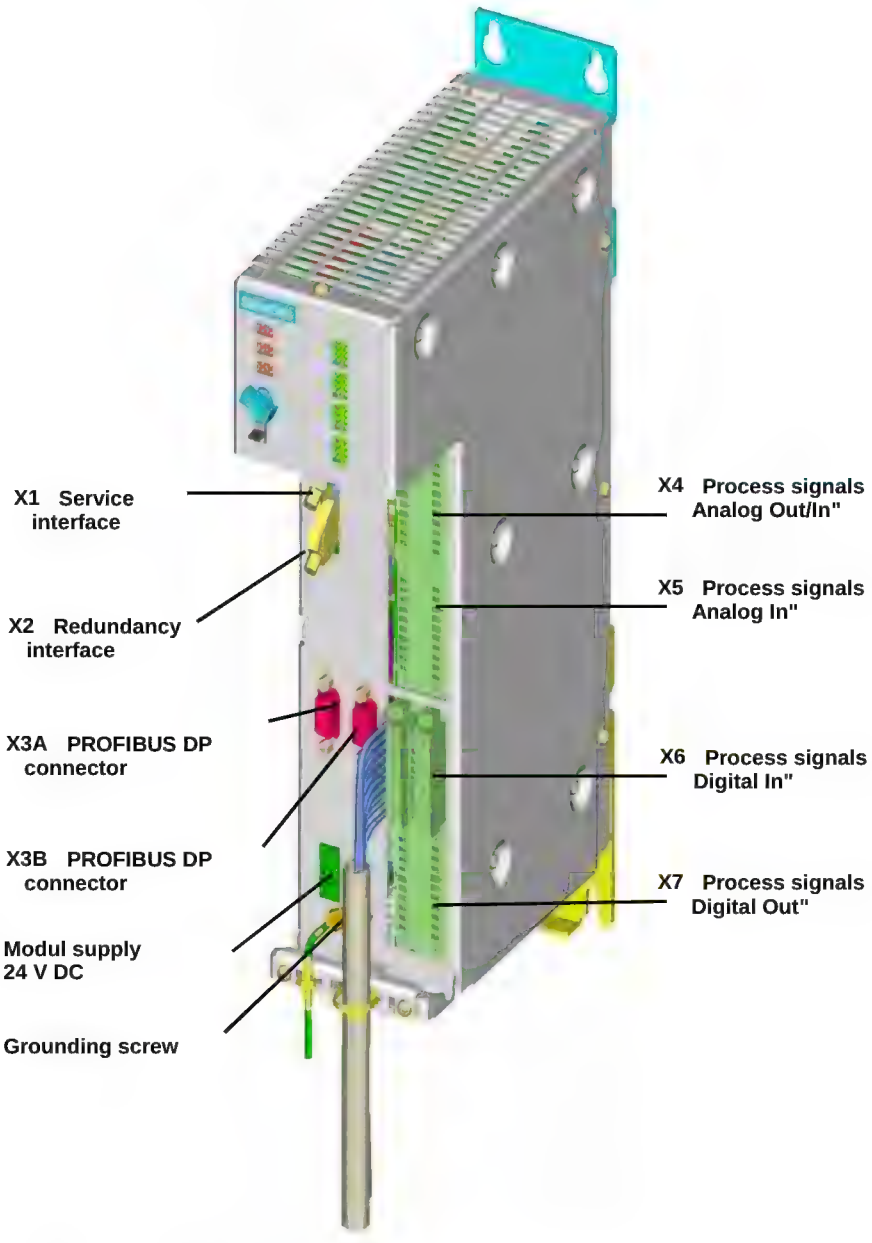

Fig. 2-1 AddFEM, front view

The AddFEM module is suitable for rail mounting, or for wall mounting on steel brackets.

Outer dimensions of the mounting elements: (W x H x D): 75 mm x 290 mm x 190 mm.

2.2 Connecting elements

Module power supply

The AddFEM is wired to the 24 V DC power supply via front connector.

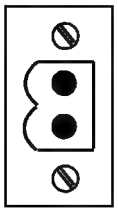

Fig. 2-2 24 V DC module supply

The module power input is limited by an electronic circuit. It is also protected by an F 2.5 A fuse (internal fuse element for the protection against damage; not replaceable.)
The AddFEM can be operated on 19.2 V DC to 30 V DC.
The 19.2 V low limit is monitored.

Load power supply

The AddFEM is equipped with an internal 24 V DC load power supply for the analog outputs. The 24 V DC load voltage for the digital outputs must be generated by an external power supply which is wired to the X7 connectors.

Grounding and electrical isolation

The front panel of the module features a grounding screw below the power supply connector. Module enclosures installed on a non-conductive or ungrounded surface must be bonded to ground using this screw (EMC shielding measure.)

Isolated function areas:

- Microcontroller area, including the analog I/Os
- 24 V DC module power supply
- Digital IOs

The 12 digital inputs are organized in groups of four, each with a common reference potential. This also applies to the three counting pulse inputs. The 16 digital outputs are distributed to two reference potentials.

Interfaces X1 and X2

- Redundancy interface X2
  For redundant operation of two AddFEM modules.
- Service interface X1
  For commissioning and maintenance.

PROFIBUS DP connectors X3A und X3B

The AddFEM is equipped with two PROFIBUS connections for communication with the automation processor.

Process connections X4 to X7

The process IO signals are wired to sockets X4 to X7. The corresponding mating connectors are equipped optionally with screw terminals or cage clamp terminals for conductor cross-sections from 0.14 mm^2 to 1.5 mm^2 (AWG 28-16.)

Function principle

3

Chapter overview

3.1 General functions

Introduction

Disruptions or errors should be detected, localized and reported within the shortest possible time. The AddFEM performs a full self-test after POWER ON (Run Up Self Test), and periodically in normal cyclic operation (Cycle Self Test.)
(see Technical data, chapter)

Self-tests/inherent monitoring function:

Components and functions included in the test:
- RAM test
- RAM checksum test RAM (calibration data, program code)
- FEPROM checksum test FEPROM (calibration data, program code)

Self-tests in cyclic mode

Certain self-test operations must be synchronized with the I/O cycle, and are thus part of this cycle.
Self-tests within the IO cycle:
- RAM test
- PROFIBUS functionality
- Data transfer host <-> AddFEM
- Data transfer <-> redundant AddFEMs
- Cycle times
- Power supply
- Channel errors of process IO
- Coprocessor monitoring by master processor

Delayed shutoff

After a brief host failure or loss of PROFIBUS DP communications, the process outputs will be shut down step-by-step on expiration of a programmable tolerance time.
This tolerance time can be set within a range from 10 ms to 3 s.
The default is 0.5 s.
(see chapter 5.5.1)

Analog input signal filters

The analog input signals can be filtered digitally. The system provides 50 Hz, 60 Hz and 16 $^{2/3}$ Hz filters. The filter parameters are set separately for each analog input (channel-specific) in the parameter frame. Options:
no filtering
- 50 Hz
- 60 Hz
- 16 $^{2/3}$ Hz

Default is "no filtering."

3.2 Operating principle of 2-channel velocity monitoring with detection of the rotational direction

Channels 1 and 2 of AddFEM 6DL3100-8AA version 8 or higher, or ADFEM 6DL3100-8AB/-8AC version 7 or higher can be operated in frequency counting mode with detection of the rotational direction. This function requires the connection of a suitable (dual-channel) encoder to channels 1 and 2. The leading signal is connected to channel 1, and the lagging signal to channel 2.

Channel 3 can be used as separate, additional single-channel monitoring function, without detection of the rotational direction.

The (signed) frequency recorded in dual-channel mode is indicated at both channels 1 and 2 as follows:

The system calculates the value of the indicated frequency separately for each channel, based on the pulses of the connected encoder. The sign (rotational direction) is determined by the phase offset of both channels and assigned to the channels accordingly.

Reaction to the failure of one of the two encoders:

If one of the two signals is lost, the velocity value of the faulty channel is stepped down to zero as in single-channel recording mode (see chapter 4 "Technical data".) The system freezes the sign status according to its value prior to the error. This method upholds the detection of the velocity at a single channel after an error has occurred. However, reversals of the rotational direction can no longer be detected.

Wire breaks can be detected by means of a parity check of the channel signals, for example. However, allowances must be made in this parity check for differences between the channel signals caused by mechanical inaccuracy in the velocity sensor (tooth edges) and acceleration (see the next chapter.) Due to the many possible applications, the channel-specific wire break detection can not be configured on the module, but rather in plant-specific parameters on the host system.

Information about refreshing and possible velocity differences of both channels:

The internal algorithm of the module always calculates the frequency (for measuring the period) based on signal transitions, and thus at different times at the two "phase-shifted" encoders.
Velocity changes will therefore cause a slight deviation of the values indicated at channels 1 and 2, because one of the channels will always return (in alternating mode) the more recent value. The timeliness and accuracy can be increased in particular in the lower velocity range by forming an average of both channel values.

Allowances must be made for the following velocity difference (nf) between both channels caused by acceleration actions:

$\Delta f = \sqrt{(f^2 + a)} - f$ (at frequencies ≤ 125 Hz)
(a = acceleration, f = frequency)

$\Delta f = a * 2\ ms$ (at frequencies > 125 Hz)

Comment: simplified formula for encoders with detection of the rotational direction and channels operating at a phase shift of 90°.

3.3 Modes of operation

System configurations

The AddFEM can be configured for operation in stand-alone or redundant mode on one or two PROFIBUS DP channels. There are four available system configurations. The configuration must be programmed. See also 5.5.1 "

Adjustable parameters"

The AddFEM module does not automatically detect and adapt a configuration. The mode of operation is set up on the AddFEM using a PROFIBUS DP parameter frame, and is determined by the required system configuration.

Note:
The basic setting selected for the AddFEM redundancy mode supports the replacement of a 6DL3100-8A**A** module with a 6DL3100-8A**B**/-8A**C** module without conversion of the configuration.

Setting the mode of operation

When using SIMATIC S7, you can configure the PROFIBUS DP parameters in HW Config of SIMATIC Manager. Use the COM-PROFIBUS software package to make the corresponding settings for other systems.

Mode	Host	AddFEM	PROFIBUS
0	single-channel	single-channel	1 PROFIBUS DP segment
1	redundant	single-channel	2 PROFIBUS DP segments
2	single-channel	Redundant	1 PROFIBUS DP segment
3	redundant	Redundant	2 PROFIBUS DP segment

Note

After POWER ON, the AddFEM holds the STARTUP (LED RUN flashes) state until its operating mode parameters are set (see chapter 5.5.1).

System configurations

Mode 0

Fig. 3-1 Mode 0

- SIMATIC AS-400, stand-alone with CPU 416,CPU 417
- AddFEM in non-redundant mode
- PROFIBUS DP integration only via PROFIBUS DP interface X3**A**

Mode 1

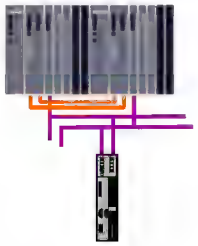

Fig. 3-2 Mode 1

- SIMATIC AS-400, redundant with CPU 417-H
- AddFEM in non-redundant mode
- PROFIBUS DP connection via PROFIBUS DP interface X3**A** and PROFIBUS DP interface X3**B**

Mode 2

Fig. 3-3 Mode 2

- SIMATIC AS-400, stand-alone (CPU 416, CPU 417) or ....
- SIMATIC AS-400, redundant with CPU 417-H
- AddFEM with redundant connection via fiber optic cable
- PROFIBUS DP integration of each only via PROFIBUS DP interface X3**A**

Mode 3

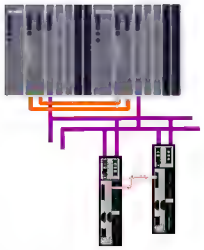

Fig. 3-4 Mode 3

- SIMATIC AS-400, redundant with CPU 417-H
- AddFEMwith redundant connection via fiber optic cable
- PROFIBUS DP integration with PROFIBUS DP interface X3**A** and PROFIBUS DP interface X3**B**

3.4 Redundancy functionality with AddFEM

Increased availability due to redundancy

In this context, redundancy refers to the implementation of a "1 of 2" structure. Availability is increased by the parallel operation of two identical components. If one of the components fails as a result of error, the standby automatically assumes the functions in a bumpless operation. The comprehensive, integrated redundancy mechanisms and self-diagnostics functions of AddFEM provide an effective means of automatic error detection and changeover of redundant stations without operator intervention

Master/Reserve

The terms “master“ and “reserve“ are used in this documentation to distinguish between both AddFEM modules. The “reserve“ AddFEM always operates in synchronism with the “master“ AddFEM, i.e. not only in error case. The process outputs of the “reserve“ AddFEM are passive, i.e. they do not output any process signals.

Features of redundant AddFEM modules

The system automatically changes over to the redundant unit if one of the AddFEM fails (“1-of-2” structure.) Bumpless transfer of master mode by means of redundant fiber optic interface.
After it has detected an error, the AddFEM initiates the master changeover, i.e. it shuts down the outputs of the previous master, and enables the outputs of the standby station. This is an almost seamless operation. (For information on tolerance-specific changeover gaps, refer to the chapter Technical data, section 4.1)

Fiber optic connection

Redundant AddFEM modules feature a serial, bidirectional fiber optic interface for redundant communication. This is used to exchange error / redundancy / update data.

Master/reserve preset

When both redundant AddFEM have a balanced error rating, the status is determined by the automation processor. This soft preset is also applied to the cyclic M/R changeover (24 h intervals.)

Forced master/reserve setting

The AP assigns the master / reserve mode if the fiber optic connection is missing or faulty

Master / reserve changeover

The master module is the active controller until it detects an error in its own system. In this case, it passes master mode to the standby module.

Master / reserve changeover without fiber-optic connection

The master station assigns the master / reserve mode if the fiber optic connection is missing or faulty. The decisive factor is here the current error rating of the modules.

Process IO

Redundant AddFEM require absolutely “symmetrical“, i.e. identical input and output signals

Redundancy nodes

Redundant nodes represent fail-safety in systems containing several identical components. A redundancy node is considered independent, if the failure of one of the components does not impair the reliability of other nodes or of the entire system. In a “1-of-2“ system, a component of the redundancy node may fail without impairing system functionality.

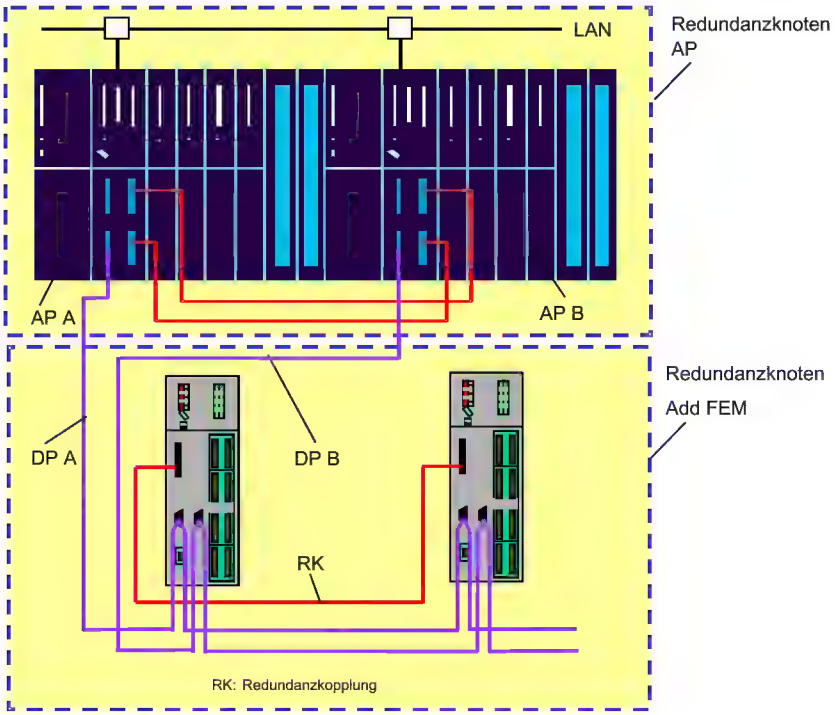

Fig. 3-5 System configuration with two redundancy nodes

The redundant automation processors AP A and AP B shown in Fig. 3-5 execute the same application software, such as a turbine loop control function, cyclically and in synchronism. One of the two systems (AP A or AP B) is the ”master” station and actively controls the outputs. After an error has been detected in the master system, master control is automatically changed over to the standby station in a bumpless operation. The redundancy status and additional update information are exchanged between AddFEM A and AddFEM B across the redundancy coupling.

3.4.1 Redundant PROFIBUS DP connection

The PROFIBUS DP channels are basically of the same priority class. The AddFEM changes the channels if it detects a DP error, sign-of-life change / error, or when it receives a GCCL (Global Control Clear) frame. A changeover of DP channels by the AP is always initiated by the sign-of-life signal. Version 6DL3100-8AC supports the PrmCommand to PROFIBUS Guideline 2.212 for the changeover of DP channels, and returns the redundancy status for diagnostics functions.

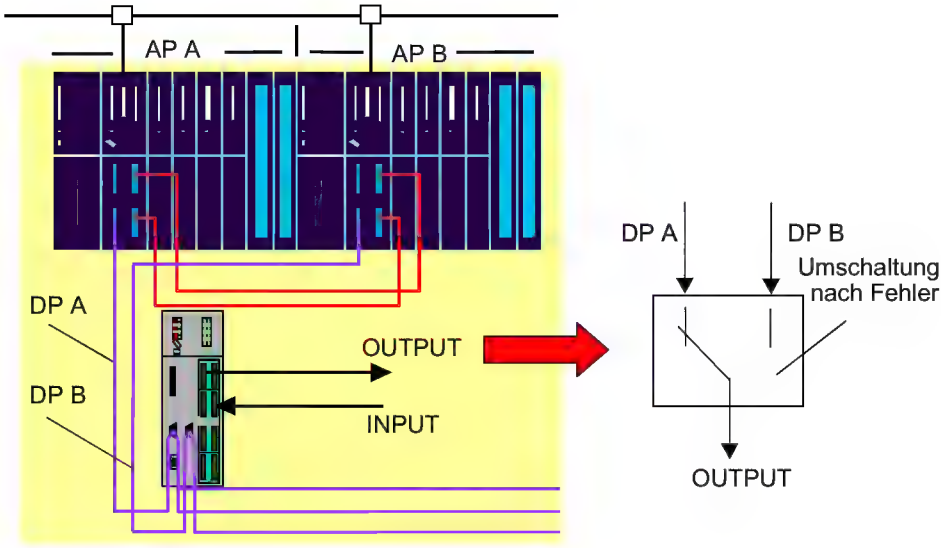

Fig. 3-6 Redundant PROFIBUS DP connection

The AddFEM and AP are interconnected via redundant PROFIBUS DP A and PROFIBUS DP B bus. Each AddFEM is equipped with two PROFIBUS DP connections. Both bus segments operate in parallel.

Input data (input) are always transferred in parallel to both automation processors. The AddFEM outputs only respond to the control signals of one of the two automation processors AP A or AP B, i.e. it always outputs either the output data of AP A or of AP B. For this reason, a master/reserve changeover also requires a corresponding adaptation of the AddFEM output status. The output information of the passive AP is analyzed for monitoring functions, and is then discarded.

The output-specific changeover is based on various criteria. The system always changes over to the operable interface as a reaction to coupling failure. In case of total failure, i.e. if both interfaces no longer receive any frames, the system outputs safety-oriented zero signals.

Note

In addition to the AddFEM's changeover of bus channels, the automation processor may also actively initiate a changeover, i.e. it can actively output a control commend to set the active bus interface DP A or DP B.

3.5 Signal preparation functions with AddFEM (applies only to 6DL3100-8AC)

AddFEM 6DL3100-8AC supports signal preparation functions for the execution of specific automation functions, such as the position control in turbine control loops. These functions can be used to outsource time-sensitive functions requiring short cycle times for the transfer of data from the master AP to the AddFEM, and thus relieve the master AP from time-sensitive tasks. This signal preparation function is referred to as Front-End-Function (FEF.)

The FEF functions are provided with default parameters which can be programmed for user-specific applications, and thus be optimized for the relevant process.

Setting FEF functions in configuration data

The FEF type can be set in the configuration data, for example, in HW Config. This configuration requires a suitable GSD file, based on the host system used. For information on using the GSD files, refer to the “readme.pdf“ file on your AddFEM CD.

Changing parameter values

Adaptation of characteristics curves, loop control parameters Kp, Tn, Tv, for example.
At the 6DL3100-8AC, the parameters are transferred in acyclic mode using DPV1 services.

PROFIBUS DP frames

When signal preparation functions are deployed on the AddFEM, additional parameter data and interim results must be transferred, at a highly dynamic signal rate. To be able to handle the transfer of such high-volume data, the signal preparation function on the AddFEM is supported by an extended PROFIBUS DP frame.

Documentation

For further detailed information on FEF function refer to the manuals of the relevant signal preparation functions on the AddFEM CD.

New FEF functions

Siemens offers an extended range of FEF functions. If your current automation components do not offer any solutions, or only cost-intensive solutions, for customer-specific applications, you can order customized solutions in the form of loadable FEF from Siemens.

Contact partner for the creation of further customized FEF applications:

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phone: +49 721 595 6053
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e-mail: robert.schwab@siemens.com

Technical data

4

Chapter overview

4.1 Technical Data

General data	
Dimensions (H x W x D)	295 mm x 75 mm x 209 mm
Weight	2,8 kg
Input voltage, reated value permissible range	 24 V DC static: 19.2 V DC to 30 V DC dynamic: 18.5 V to 30.2 V
Rated input current Module supply Load supply	 0.8 A 8 A
Inrush current Peak Half intensity width	 3 A, limited 100 ms
Buffering of power failure	at least 10 ms, at input voltage 19.2 V DC to 30 V DC
Cumulative power loss of AddFEM - Module supply - Supply at digital inputs - Supply at analog inputs - Switching and feed forward losses at digital outputs on load power supply	max. 33 W (cumulative) max. 20 W max. 4 W max. 1 W max. 8 W
Module power supply fusing	2.5 A, fast-blow (internal protection, not replaceable)
Load power supply fusing	2 x 7 A, fast-blow (internal protection, not replaceable)

Electrical isolation

The module consists of several electrically isolated function groups. The potential difference between these function groups may not exceed 50 V when the system is in operation.
Assignment of signals and connections to the various function groups:

a) Analog IO (connectors X4/1 to X4/20, and X5/1 to X5/20), including the internal microcontroller area
b) Count pulse inputs (connectors X6/1 to X6/4)
c) Digital inputs 5 to 8 (connectors X6/6 to X6/10)
d) Digital inputs 9 to 12 (connectors X6/11 to X6/15)
e) Digital inputs 13 to 16 (connectors X6/16 to X6/20)
f) Digital outputs 1 to 8 (connectors X7/1 to X7/10)
g) Digital outputs 9 to 16 (connectors X7/11 to X7/20)
h) PROFIBUS DP connector X3A
i) PROFIBUS DP connector X3B
j) Module power supply 24 V DC
k) Enclosure

PROFIBUS DP interfaces	
Number of interfaces	2
Transmission rate	9.6 kbps to 12 Mbps
Max. cable length of a bus segment terminated at both ends	100 m
Permitted load on the 5–V power supply f the bus for the connection of further nodes without internal power supply	max. 80 mA per interface
For detailed information on PROFIBUS, refer to SIMATIC NET, PROFIBUS Networks manual, order no. 6GK1970-5CA20-0AA0!	

IO cycle times (PROFIBUS and connectors X4 to X7)	
Analog signal acquisition	666.667 µs
Analog signal output	666.667 µs
Digital signal acquisition[1)]	666.667 µs
Digital signal output	666.667 µs
Count pulse input	2 ms

[1)] Refresh signal at intervals of 666.667 µs. Signal filtering incurs an additional dead time of 666.667 µs between acquisition and output.

Digital inputs	
Number of inputs	12
Type of input to IEC 61131-2	Type 1
Voltage range	- 30 V DC to + 30 V DC
0 signal level	- 30 V DC to + 5 V
1 signal level	+ 11 V to + 30 V
48 V contact voltage	no
Connection of BEROs supported	yes
Min. current at input voltage	5 mA at 11 V (see Fig. 4-1)
Delay time (TID)	50 µs at 0 > 1 signal transition 50 µs at 1 > 0 signal transition
Displays	Front panel LEDs; indicate the converted values read by the internal microcontroller unit.
Terminal assignments	See appendix A, connector X6, page A-2

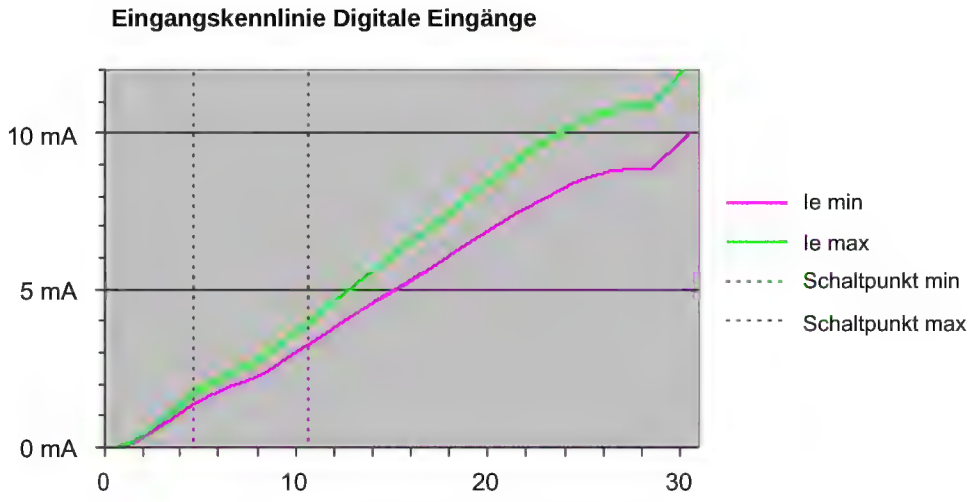


Fig. 4-1 Trend of digital inputs

Count pulse inputs [1)]	
Number of inputs	3
Type of input to IEC 61131-2	Type 1 / 2
Voltage range	- 28 V DC to + 28 V DC
0 signal level	- 28 V to + 3 V
1 signal level	+ 8 V to + 28 V
Demand factor when operated at a voltage > 26 V	The count pulse inputs are also specifically designed to handle low input voltages (high signal detection => 8 V.) To limit power losses, either the input voltage must be limited to 26 V, or a 60% pulse/pause ratio with a maximum pulse width of 1 minute must be maintained, or only two of the three inputs may be set high at any given time.
Load	1 kΩ to 3 kΩ
Current/ voltage profile across the working range	See Fig. 4-1!
Dealy time (TID)	50 µs at 0 > 1 signal transition 50 µs at 1 > 0 signal transition
Cyclic evaluation of all signals	2 ms Noise pulses < 10.667 µs are suppressed by filtering. Additional hardware evaluation by counters.
Input frequency (f_{in})	0 kHz to 20 kHz
Counter resolution	32 bit
Measuring accuracy	better than 10^{-4}
Refresh interval	2 ms
Measuring time at frequencies < 800 Hz	20 ms
Filter	At each refresh scan cycle point, the system recalculates the frequency based on a mean value derived from the count pulses logged within the last 20 ms.
Detection of the rotational direction	The rotational direction can be determined by coupling channels 1 and 2. See chapter 3.1 (supported as of version 8 of 6DL3100-8AA, version 7 of 6DL3100-8AB, and by all versions of 6DL3100-8AC)
Displays	Front panel LEDs; indicate the converted values read by the internal microcontroller unit.
Terminal assignments	See appendix A, connector X6, page A-2

Count pulse inputs may also be used as digital inputs!

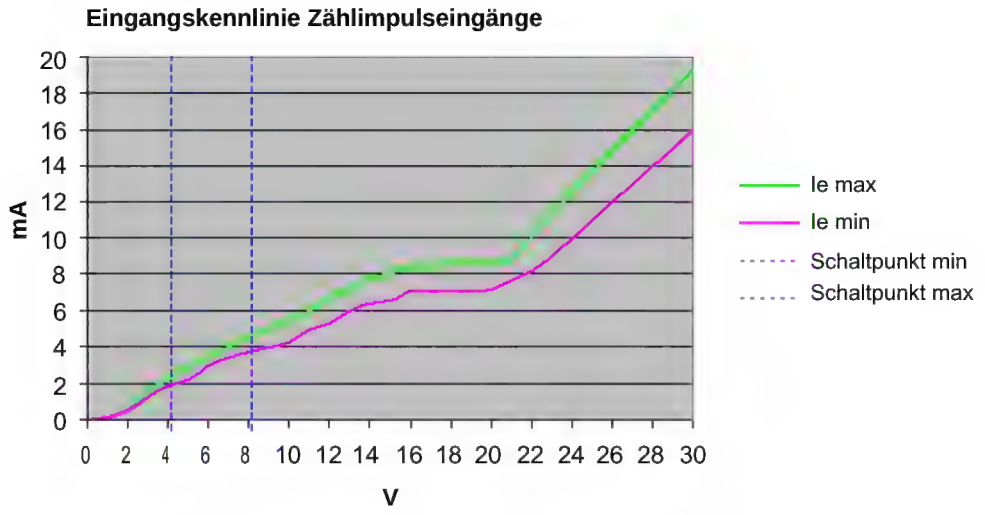


Fig. 4-2 Count pulse inputs, characteristics diagram

Reaction of the count pulse/rotational direction detection functions to interruption of the pulses (due to wire break, for example)

A) Single-channel mode (without rotational direction detection)
(applies to 6DL3100-8AA/-8AB version 7 or higher, and to all 6DL3100-8AC)

Frequency output will be limited according to the period of the last recorded pulse if no more count pulses are received. The limit frequency F is derived from the period T since the last pulse by the formula

F= 1/(T-dead time) * 1.5

The dead time of 0 ms to max. 2 ms is derived from the detection cycle time.

In practical life, we derive the limit frequencies from the output limits (see the table below), provided the original frequency measured prior to the pulse failure was higher.

The value will be set to zero on expiration of 10 s. (frequencies below 0.1 Hz are not recorded.)

Interval T since last pulse	Limiting of frequency output to the values listed below
0 ms to max. 2 ms	Old frequency is retained. At a detection cycle =< 2 ms, a missing pulse can not be detected.
2 ms to max. 4 ms	Limiting to max. 750 Hz
4 ms to max. 6 ms	Limiting to max. 375 Hz
8 ms to max. 10 ms	Limiting to max. 187.5 Hz
18 ms to max. 20 ms	Limiting to max. 83.3 Hz
48 ms to max. 50 ms	Limiting to max. 31.3 Hz
98 ms to max. 100 ms	Limiting to max. 15.3 Hz
0.998 s to max. 1 s	Limiting to max. 1.5 Hz
9.998 s to max 10 s	Limiting to max. 0.15 Hz
> 10 s	Output will be set to 0, i.e. frequencies below 0.1 Hz will not be recorded, or always set to 0.

For information on the reaction of the counter pulse inputs of 6DL3100-8AA/-8AB versions < 7 to wire break, refer to the product information included on the same documentation CD.

B) Reaction of the dual-channel count pulse / velocity detection (with detection of the rotational direction) to channel failure:
(applies to 6DL3100-8AA version 8 or higher; 6DL3100-8AB version 7 or higher, and all 6DL3100-8AC)

If one of the two channels fails, the velocity value is stepped down to zero as in single-channel detection. The sign is frozen at the state it had prior to the error event. It is thus still possible to detect the velocity using only one channel, however, without detection of any changes in the rotational direction.

Note

For information on wire break monitoring, refer to chapter 3.2, "Operating principle of 2-channel velocity monitoring with detection of the rotational direction"

Caution

Operation of the count pulse / velocity detection function with detection of the rotational direction in control systems for water-driven turbines is not permitted with earlier versions than those specified above, because there the values returned by the velocity and rotational direction detection function will be corrupted sporadically (flutter.)

Digital outputs [1]	
Number of outputs	16 digital semiconductor outputs
Rated output voltage	DC 24 V
Output voltage at 0 signal	< 1 V
Output voltage at 1 signal	supply voltage – 2 V
Max. output current	500 mA Parallel wiring of outputs for higher currents is supported.
Output current at 100% demand factor	500 mA
Cumulative output current	8 A
Effect of repeated overload on multi-circuit modules	none
Monitoring of short-circuit to M	yes
Short circuit-proof	yes
Max. lamp load per output	5 W
Inductive loads Typical values: Max. inductivity at I ≤ 500 mA and f ≤ 1 Hz Max. inductivity at I < 250 mA and any f Max. inductivity with external suppression diode	Connection of inductive loads is supported. Compared to standard suppression diodes, the suppression voltage of integrated suppression diodes is increased by 39 V, and accelerate the shutoff of the current and, thus, of the final control element. However, the maximum suppression power (1 W) may not be exceeded. 8 H (without external suppression diode) unlimited unlimited
Output delay (TQD, Totzeit) between command output and response of the output (start of current rise)	20 µs at 0 > 1 signal transitions 20 µs at 1 to 0 signal transitions
Output response time (TQT) between command output and transient state of the output current at 500 mA	50 µs at 0 > 1 signal transitions 50 µs at 1 > 0 signal transitions
Reaction to the interruption of runtime controlled by the master processing unit	Shutoff of the outputs
Reaction to dips and interruption of the power supplies L1+ or L2+ at X7/1 or X7/11	The output voltage follows the supply voltage.
Displays	The voltage level of the digital outputs is logged by the internal digital inputs of the module, and is then converted and read by the internal microcontroller unit. The microcontroller unit outputs the read states to the front panel LEDs.
Terminal assignments	See appendix A, connector X7, page A-2

[1] Digital outputs may also be used as digital inputs!

Analog inputs	
Input impedance across the signal range	
for current measurement	41.8 Ω
for voltage measurement	100 kΩ
Measuring error	
Max. error at 25 °C	± 0.12 %, at 0 V CMV
Temperature coefficient	± 25 ppm/K
Max. error across the temperature range	± 0.2 % relative to measuring range limit at a CMV of max. 2 V
Digital resolution of the D/A converter	13 bit + sign
Value of the least significant bit (LSB)	
bei Strommessung	4 µA
bei Spannungsmessung	2 mV
Highest permissible continuous overload (no damage)	60 V
Output of the digitized analog value under load	118 %
Input type	Differential
CMV range	± 6 V
CMV suppression	
DC	- 0.05 % / V
50 Hz	55 dB
60 Hz	55 dB
Total system input transfer time (TAID + TAIT)	52 µs
Scan time including settling time	20 µs
Scan cycle interval time	104.167 µs
Input filter of the first order	
Transition frequency	880 Hz
Mean value formation across four measurements	
Transitional frequency including input filter	700 Hz
Max. short-term offset during any defined electrical error test	See EMC data (chapter 4.2)
Conversion method	successive approximation / parallel conversion of 4 channels
Mode of operation	autoscan
Calibration	not required
Terminal assignments	See appendix A, connector X5, page A-1!

Analog inputs (continued)	
Measuring ranges of current inputs / overflow range	0 mA to 20 mA / A to – 3.511 mA to 23.7 mA 4 mA to 20 mA / – 1.185 mA to 22.96 mA ± 20 mA / ± 23,7 mA ± 30 mA / ±35,55 mA
Measuring range of voltage inputs only at channels 1 to 6	0 V to10 V / -1.755 V to 11,85 V ±10 V / ±11.85 V
Number and function of inputs	6 current measuring inputs, 6 current/voltage measuring inputs
Crosstalk between channels at	
DC	≤ 60 dB
50 Hz	≤ 60 dB
60 Hz	≤ 60 dB
Non-linearity	< 0.01 %

Analog outputs	
Number of analog outputs	8
Max. error at 25°C	± 0.15 %
Temperature coefficient	± 100 ppm / K
Max. error across the temperature range	± 0.4 %
Value of the least significant bit (LSB)	13 bit + sign
Value of the least significant bit (LSB)	8 µA
Total system transfer time (TAQD + TAQT)	1 ms
Transient time across the full range	0.6 ms
Overshoot	0.2 %
Max. short-term offset during any defined electrical error test	See EMC data (chapter 4.2)
Terminal assignments	See appendix A, connector X4, page A-1
Max. permitted inductive load	1 H
Power Off operations	Buffer time up to 10 ms. With prolonged failure, power on is determined by software functions
Conversion method	parallel conversion of all 8 output channels
Current output range unipolar / overflow range / load	0 ... 20 mA /± to 23.5 mA / 480 Ω 4 ... 20 mA / – 4,96 bis + 22,96 mA /480 Ω
Current output range bipolar / overflow range / load	± 20 mA / ± 23.5 mA / 480 Ω ± 30 mA / ± 35.55 mA / 300 Ω
Current output bipolar (only channels 1 to 4) [1)]	± 50 mA / ± 59.26 mA / 150 Ω
Output current monitoring tolerance	4 %
Cross-talk between channels at: DC 50 Hz 60 Hz	 ≤ 60 dB ≤ 60 dB ≤ 60 dB
Non-linearity	t 0.1 %
Output ripple	t 0.1 %

1) In order to protect the module, the analog outputs 1 to 4 are limited to an average load of 40 mA. The extension of the current range of those outputs to 50 mA / 59.26 mA is only intended for the control of final control elements with integral action. A max. current of 59,26 mA is provided to this purpose for a limited time.
The current is monitored by the software and limited as follows.
Mean value limiting: At a current output programmed for operation at ±50 mA, the mean value of the output current is calculated based on a delay element of the first order which has a time constant of 10 s. If the current exceed a mean value of 40 mA, both the output current and its mean value will be limited to ±40 mA.

4.2 Safety, environmental conditions and EMC

Certifications:

6DL3100-8AA/-8AB/-8AC is certified to:

- UL-Recognition-Mark: Underwriters Laboratories (UL) to Standard UL 508
- CSA-Certification-Mark: Canadian Standard Association (CSA) to Standard C 22.2 No. 142

CE label

6DL3 100-8AA/-8AB/-8AC meets requirements to

EC Directive 89/336/EEC "Electromagnetic Compatibility" and
EC Directive 73/23/EEC "Low-voltage Directive."

Safety	
Device standard	EN 61131–2, IEC 61131–2, parts 11 to 14
Inherent heating	The enclosure made of steel sheet is subject to an excess temperature of approx. 20 K under full load. The temperature limit of 70 °C is thus exceeded at an ambient temperature of 60 °C, which still allows unprotected contact without any risk of injury (to DIN EN 61131–2.).
Power supply	The 24 V DC power supply must be a safety extra-low voltage which is safely isolated from mains. This isolation may be implemented in accordance with VDE 0100 Part 410 , HD 384.4.41 , IEC 60364–4–41 (as functional extra-low voltage with safe isolation PELV) or to EN 60950-1, IEC 60950-1 (as safety extra-low voltage SELV).
Installation safety requirements	6DL3100-8AA/-8AB/-8AC is an “open equipment“ to DIN EN 61131–2 standard, and according to UL/CSA certification an “open type.“ In order to satisfy operational safety requirements with respect to mechanical strength, non-inflammability, stability and touch protection, the following installation methods are mandatory:: Installation in a suitable cabinet Installation in a suitable enclosure Certified only to DIN EN 61131–2: Installation in a closed switch room with appropriate equipment
Electrical isolation	Isolation of the areas specified in chapter 4.1 is designed for normal operation at a rated voltage of 50 V. The routine insulation test is carried out to UL 508 (test voltage/duration 707 V DC / 1 min, or optional at 849 V DC / 1 s when the test object is switched off.
Foreign matter and water-proofing	Degree of protection IP20 to IEC 529, i.e. protected against contact with standard test fingers. Not water-proof.
Sound emission	None

Reliability	
MTBF value to SN 29500	23 years, at an ambient temperature of 40 °C at the module

ElectroMagnetic Compatibility (EMC) **The specified values apply to systems equipped with shielded process cables for analog signals. Digital signal cables may unshielded. The values specified apply to conditions without shielding effect of a cabinet, and without aditional external protective elements.**	
Stress	**Test values**
Radiated noise	Limit class A to EN 55011 / 2000 Group 1
RF interference on cables and cable shielding to IEC / EN 61000-4-6	10 V 9 kHz to 80 MHz 9 kHz to 80 MHz (with 80 % amplitude modulation of 1 kHz) Possible deviation of analog output signals < 3 %
RF radiation to IEC / EN 61000-4-3	10 V/m 80 MHz bis 1 GHz (with 80 % amplitude modulation of 1 kHz) 10 V/m 900 MHz (with 50 % pulse modulation)
Burst pulses (high-speed transient disturbance variables) to IEC / EN 61000-4-4	±2 kV on power supply lines and signal lines
High-energy surge pulse (1.2/50 ms surge pulse) to IEC 61000–4–5 Asymmetrical coupling Symmetrical coupling	 ±2 kV at the power supply lines ±2 kV at the signal lines Coupling effect on unshielded cables carrying binary signals, and on the cable shielding of shielded analog signals and PROFIBUS DP ±1 kV a power supply and signal lines Information on 1.2/50 ms pulse/surge test: The surge test simulates high-energy disturbance which might be coupled to cables with a length of more than approx. 10 m, thus being superimposed on user signals, depending on ambient conditions (to standards.) The period of the various noise signals generated by the surge pulse lies within the range of the sampling frequency/ cycle time of the module. At those extremely short cycle times, hardware filtering is an inadequate means of suppressing noise signals, because of the unwanted filtering effect on user signals. The 50 or 60 Hz filter should therefore be switched on at the analog outputs if surge noise coupling on signal lines is to be expected due to given ambient conditions and cable lengths. With active filter, distortion of analog signals due to surge coupling is reduced to less than 2 %. Without filtering, short-term signal distortion of 60% can be expected at the analog inputs.
Immunity against discharge of static electricity to the housing and parts of the structure to IEC / EN 61000-4-2	±6 kV Contact discharge ±8 kV Air discharge

Climatic conditions	
Temperature (ambient temperature) Operation	Tested to DIN EN 60068-2-1, DIN EN 60068-2-2, 0 °C to + 50 °C at rated load (siehe Kapitel 4.1) 0 °C to + 55 °C at rated load; digital outputs 5, 6, 7, 8 sowie 13, 14, 15 und 16 jedoch mit max. 200 mA belastbar 0 °C to + 60 °C at rated load; digital outputs 3 to 8 and 11 to 16, but with max. 120 mA load; Input voltage at the binary inouts max. ± 28 V; normal operation on PROFIBUS, without load on the additional PROFIBUS supply for 90 mA (i.e. no nodes without internal supply, for example, fiber optic converters, connectable) maximum temperature gradient 10 °C / hour
Storage / packaged ready for shipping	Tested to DIN EN 60068-2-1 and DIN EN 60068-2-2: - 40 °C to + 70 °C maximum temperature gradient 5 °C / hour (Risk of dewing at higher temperature gradients. Dewing is not permitted.) With longer shelf times it is advisable to put the modules into operation for approx. one hour at regular intervals, in order to prime the electrolytic capacitors: At shelf temperatures up to 40 °C: after 5 years within the first 10 years, then at intervals of 3 years; At shelf temperatures above 40 °C: at intervals of 2 years;
Relative humidity Operation	max. 95 % bei + 25 °C, dewing is not premitted, corresponds with relative humidity (RH) stress group 2 to IEC 61131–2. Tested to IEC 60068-2-78: 95 % at 30 °C
Storage / packaged ready for shipping	Max. 95 % at + 25 °C, dewing not permitted; Tested to IEC 60068-2-30: 95 % at 25 °C to 55 °C
Barometric pressure	Storage: 1080...660 hPa (-1000 to + 3500 m) Operation: 1080...900 hPa (-1000 to + 1000 m) The cooling effect is reduced at higher elevations, i.e. the high temperature limit may be reduced (guide value: 10 K/1000 m, starting at 1000 m above sea level)
Pollutant concentration	$S0_2$ < 0.5 ppm, rel. humidity < 60 %, no condensation H_2S < 0.1 ppm, rel. humidity < 60 %, no condensation

Mechanical ambient conditions	
Vibration operational, with screw mounting or rail mounting (see chapter 5.1)	Tested to DIN EN 60068-2-6: 10 Hz to 58 Hz: amplitude 0.075 mm 58 Hz to 500 Hz: acceleration 1 g (10 m/s^2) Excitation signal: floating sine wave Frequency transient: 1 octave/min, 10 cycles per axis
Packaged ready for shipping	Tested to DIN EN 60068-2-6: 5 Hz to 8.5 Hz: amplitude 3.5 mm 8.5 Hz to 500 Hz: acceleration 1 g (10 m/s^2) Excitation signal: floating sine wave Frequency transients: 1 octave/min, 10 cycles per axis

Mechanical ambient conditions	
Continuous shock	
operational, screw-mount or rail-mount test object (see chapter 5.1)	Tested to DIN EN 60068-2-29: Half-wave sinusoidal: 10 g (100 m/s^2) for 16 ms 100 shocks per axis Note: rail mounting to DIN EN 60715 (min. material thickness. 2.2 mm.) In addition to the side brackets, a center bracket is required for DIN rails with a length of 19 inches in order to ensure safe and rigid fixation of the module on the rails Tested to DIN EN 60068-2-27: Half-wave sinusoidal: 25 g (250 m/s^2). duration 6 ms 1000 shocks per axis
Packaged for shipping	

Dust endangering functionality	
The AddFEM must be protected against the ingress of any conductive and corrosive matter. For other dust and sand particles, conditions of use to IEC 60 721-3-3 classe 3S2.	
Special features	
QC	to ISO 9001

4.3 Processing times

Causes of redundancy changeover of redundant modules (only 6DL3100-8AB/-8AC)	
According to priority (error rating)	**Cause**
Forced reserve selection	- FRS signal from automation processor in case of failure of the redundant fiber optic connection - Mode selector switch to STOP
Module error	- Speichertest des RAM Datenbereichs - Checksumme über den Programm-Code im FEPROM/RAM - Ausfall der Versorgungsspannung/Unterspannung
Central unit failure	- PROFIBUS DP failure - Ausfall des Automatisierungsprozessors
Channel error	- Channel error at analog input, analog output, digital output, or - failure of the 24 VDC power supply to the digital outputs
Channel error rating	- Sum of all channel errors. Identical rating of all channels.

CPU failure detection time	
PROFIBUS DP	The active reaction monitoring time is calculated based on the relevant values returned in the parameter assignment frame (see PROFIBUS standards)
Sign-of-life	2 x automation processor cycle

Channel error detection time [1]	
Analog inputs Max. delay of qualifier QU (bit 0 of the relevant analog value AI 0 to 12) in the input frame	42.00 ms
Analog outputs Max. delay of qualifier AO 1 ... 8 in the input frame	12.667 ms 28.667 ms (at 6DL 3100-8AA up to version 6)
Digital outputs, or load voltage dips Max. delay of qualifier DO 1 ... 16 in the input frame	2.00 ms

[1] The error detection times of signal evaluation are a multiple of the cycle time due to error filtering. Error filtering prevents the generation of an error message triggered by disturbance pulses or single error events

Cylce time of memory tests (only 6DL3100-8AB/-8AC)	
RAM test: "stuck-at-zero" and "stuck-at-one" error check	24.5 s
Checksum of the program code in RAM	1.2 s
Checksum of the program code in FEPROM	2.5 s
Note: In cyclic mode, the program code in RAM will be used	

Changeover of PROFIBUS DP channels	
Gaps when changing over between PROFIBUS DP channels	no changeover gap

Changeover gaps with module redundancy (only 6DL3100-8AB/-8AC)	
Changeover gap with functional redundant fiber optic connection	
Digital outputs	0 to 100 µs
Analog outputs	0 to 300 µs
Changeover gap due to missing or faulty redundant fiber optic connection [2)]	
Digital and analog outputs	1 automation processor cycle + 1 PROFIBUS DP token + 1 AddFEM cycle

[2)] If the redundant fiber optic connection fails, the AP determines the master / reserve assignment. Decisive factor is here the current error rating of the modules.

Commissioning, operation, maintenance 5

Chapter overview

5.1 Installing the AddFEM

The brackets of the AddFEM are adaptable and are thus suitable for mounting the AddFEM module on DIN rail, or for wall-mounting.

Always secure the 24 V DC power supply and process cables on the strain relief.

Installation to DIN EN 61131-2

6DL3100-8AA/-8AB/-8AC is an "open equipment" to DIN EN 61131–2 standard, and an "open type" according to UL/CSA certification.
In order to satisfy safety requirements with respect to mechanical strength, non-inflammability, stability and touch protection, the following installation options are mandatory:

- Installation in a suitable cabinet
- Installation in a suitable enclosure
- Certified only to DIN EN 61131-2:
  Installation in a closed switch room with appropriate equipment.

Caution

The enclosure made of steel is subject to an excess temperature of approx. 20 K under full load. The temperature limit of 70 °C is thus exceeded at an ambient temperature of 60 °C, which still allows unprotected contact without any risk of injury (to DIN EN 61131–2.)

Mounting options

Module mounting options:

- Mounting on double DIN rail (factory configuration)
- Direct screw-mounting on a wall

DIN rail mounting

The minimum clearance (measured center <-> center) between the top and bottom DIN rail is 165.1 mm (see the dimensional drawing for DIN rail mounting.) The minimum stiffness of the DIN rail structure must be sufficient to ensure safe fixation of the module. We therefore recommend the installation of rails to DIN EN 60715 (minimum material thickness: 2.2 mm), with a fastening pitch of less than 25 cm. DIN rails with a length of 19 inches should be bolted at the sides and in the middle.

How to mount the AddFEM on the rail:

- Place the top fastening strap onto the top of the rail, then "hang in" the module.
- Push the lower fastening element onto the bottom DIN rail.
- The lower fastening element is slotted at the level of the enclosure bottom. Insert a flat screwdriver into this slot at an angle, working from the bottom (see the dimensional drawing of rail mounting), then push the blade towards the floor panel of the enclosure. This counters the spring force of the clip and forces the clip down. You can now snap the AddFEM onto the lower DIN rail.
- Remove the screwdriver. The AddFEM is now safely secured.

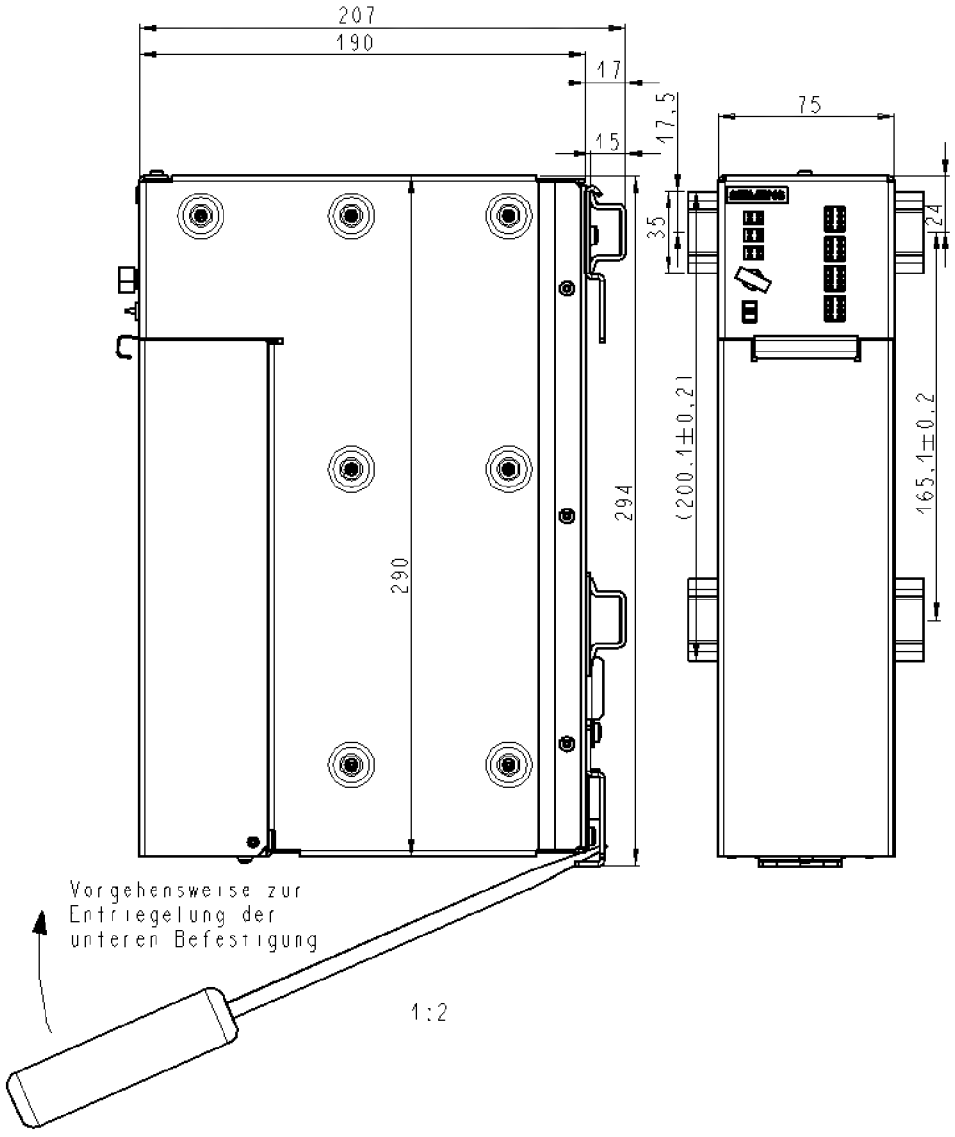


Fig. 5-1 Dimensional drawing of the DIN rail mounting

Screw-mounting

In order to screw-mount the module directly onto a panel or wall, remove the brackets at its rear, turn them around and screw them on again. You need four M5 screws to bolt down the module. The drawing below shows the bore and pitch dimensions.

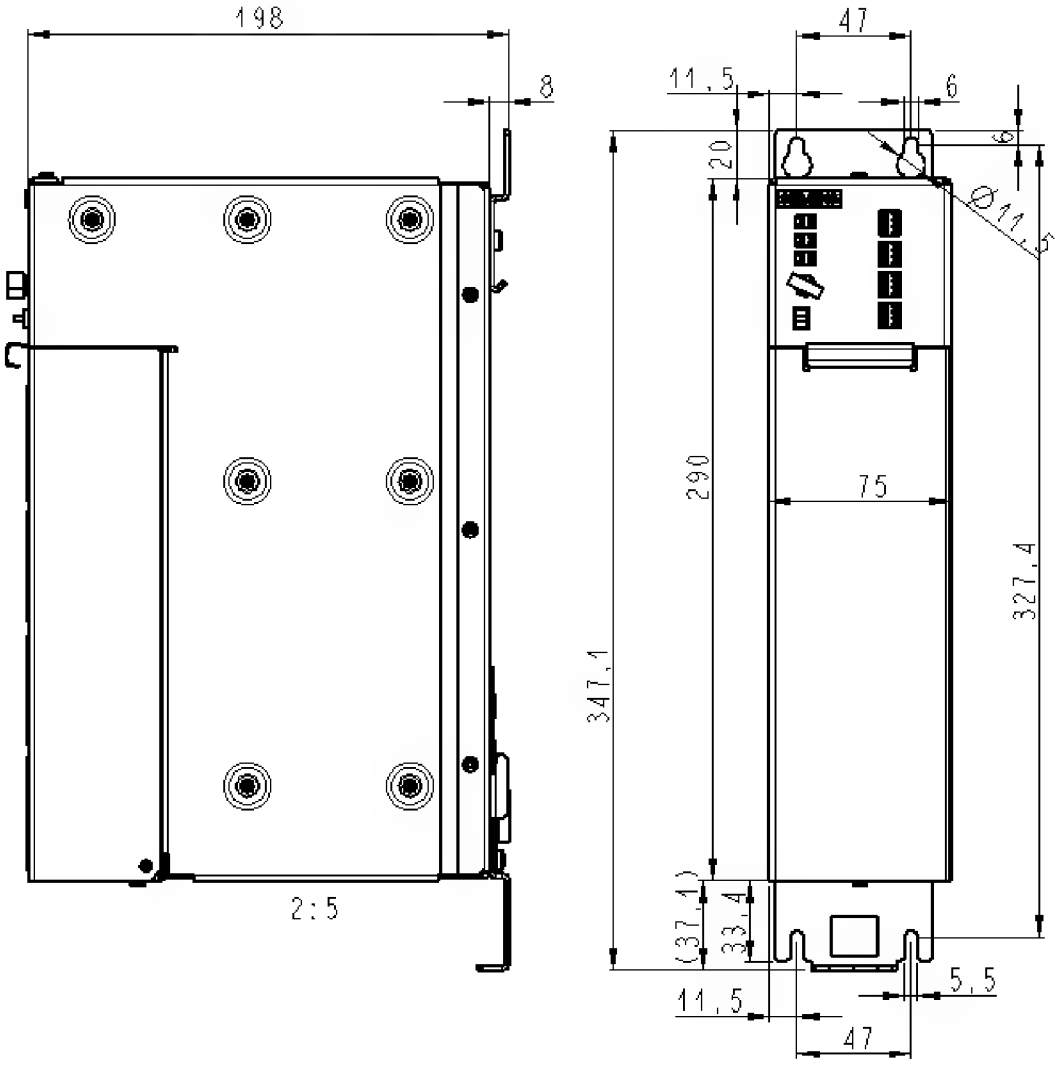
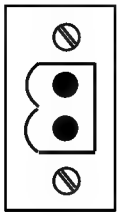


Fig. 5-2 Dimensional drawing of screw-mounting

Module power supply

The 24 V DC power supply is connected to the AddFEM using the dual-pole connector of the AddFEM connector set, order no. 6DL9900-8AA. At an ambient temperature of 60 C, the terminal temperature may reach 70 C (The cable insulation should thus be certified for a temperature 75 C.)



M: Bezugspotential

L+: Einspeisung +24 V

Fig. 5-3 24 V DC module power supply

Always use solid wire or stranded wire with wire end ferrules to connect the module to the 24 V DC power supply (stripping length: 7 mm).
Tightening torque of the screw terminals of the connector:
0.5 N/m to 0.6 N/m

Warnung

The 24 V DC module power supply must be a safety extra low voltage (SELV) which is safely isolated to mains. Safe electrical isolation may be implemented to VDE 0100 part 410, corepsonding to HD 384.4.41 and IEC 60364-4-41 (as functional extra-low voltage with safe isolation PELV) or EN 60950-1, IEC 60950-1 (as safety extralow voltage SELV).

Load voltage supply to digital outputs

AddFEM supplies the 24 V DC load voltage to the analog outputs. The 24 V DC load voltage for the digital outputs must be generated externally, and is wired to the X7 connectors.

Wiring process signals

Cable type: Cables carrying analog signals must be shielded in order to achieve maximum protection against interference (see "Supplementary data on safety, environmental conditions and EMC "). You may use unshielded cables for the transfer of digital signals.

In accordance with the UL / CSA certification of the matching front connectors for sockets X4 to X7 (connectors with 10 screw terminals, AddFEM connector set, order no. 6DL9900–8AA), process signals may only be connected using solid copper wire or stranded wire with wire end ferrules (stripped length: 9 mm). At an ambient temperature of 60 C, the temperature in the area of the terminals may reach 70 C. The cable insulation should therefore be certified to withstand a temperature of 75 C.

Tightening torque of the screws: 0.22 N/m to 0.25 N/m.

Warning

Please note that transients or faulty connections may cause the transfer of hazardous voltages to the module via the connectors. Hazardous voltages may develop at the following connecting points:

Fixing screws:

A hazardous voltage may be transferred to the screws when you handle the connectors or cables.

Contact pins of the module front connector:

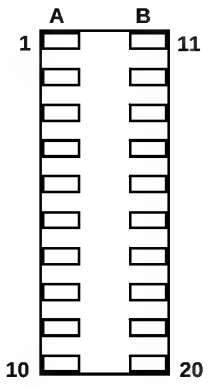
The module could divert hazardous voltages from the already closed to still open contact pins of the front connector if the connector is not fully inserted.

Close the front cover of the AddFEM after you installed the process signal connectors and secured the cables. Always disconnect the process connections, or take other appropriate measures in order to prevent contact with open pins or fixing screws before you remove the protective cover.

Cable strain relief

The AddFEM front panel is equipped with a strain relief rack made of metal which is used to secure the cables and wires using cable ties. You can remove this rack, including the cables and wires mounted to this rack, by loosening the two screws, and then mount it onto the replacement module.

5.2 Socket pin assignment



The 4 connectors on the front panel have an identical design and numbering

The upper two connectors (X4, X5) are reserved for analog signal. The lower two connectors (X6, X7) are used for the digital signals and velocity monitoring signals.

For pin assignments, refer to the tables in appendix A.

Fig. 5-5 Process connector

Of the 12 analog inputs, 6 can be used as current or voltage input, while the remaining 6 can only be used as current input.

The 16 digital outputs can also be used as inputs.

Of the 15 digital inputs, 3 can be used as counter input for velocity monitoring with / without detection of the rotational direction. For velocity monitoring with detection of the rotational direction, count pulse input 1 detects the leading, and count pulse 2 the lagging signal.

Shielding

Cable shielding: The shielding of cables carrying analog signal and of PROFIBUS DP cables should be clamped and bonded to ground upstream of the terminals on the module. If the cables not bonded to ground further downstream at the strain relief, any high-energy interference from the shielding will be discharged across the module enclosure, and thus impair the module's resistance to interference.

You may use unshielded cables for digital process signals.

Enclosure: The module enclosure must be bonded to ensure EMC compatibility. It suffices to mount the module onto a grounded DIN rail or mounting panel. If suitable mounting elements are not available, the enclosure must be connected to ground separately at the grounding screw on the front panel below the module's power socket. This screw can be connected to a grounded cable.

For further information on system installation with respect to lightning protection, grounding etc., refer to the SIMATIC PCS 7 documentation package on your CD-ROM. See catalog ST PCS 7.

Cabinet technology

You may install the AddFEM alongside with distributed IO devices or master processing units of the SIMATIC S7, SIMATIC PCS 7 or SIMADYN-D family in the

same switch cabinet. Siemens has optimized its switch cabinet technology according to the special requirements of these system families.

The cabinets consist of system-specific and neutral modules which are compliant with CE standard, i.e. these are compliant with EMC Directives on electromagnetic compatibility. The cabinets safely prevent unauthorized access, and mechanical influences, contamination and corrosion.

Due to their modularity and variability, the cabinets can be easily adapted to satisfy requirements of diverse plant types and dimensions.

Your contact partner for the configuration and installation of customized system cabinets:

Siemens AG
A&D SE SP3
Mr. Rieder
Phone: +49 721 595-2528
Fax: +49 721 595-4711
Siemensalle 84
D- 76181 Karlsruhe

Hardware maintenance

Faulty AddFEM modules can not be repaired on-site, and must be shipped back to SIEMENS. Always keep the AddFEM dry when cleaning it.

Accessories (cables and connectors)

a) Add FEM connector set for process cable connections and for the module power supply (one set required per AddFEM), order no. 6DL9900-8AA.
The set consists of:
- 8 connectors, each with 10 screw terminals for wiring the process cables of a module to sockets X4 A/B to X7 A/B
- 1 connector, with 2 screw terminals, for wiring the 24 V DC power supply to the module

b) **PROFIBUS DP cables and connectors for the AddFEM:**
The current order numbers for these accessories are available either in the Siemens catalog IK 10, Industrial Communication, or on the Internet at http://www.ad.siemens.de, "Products and Solutions", "Automation Systems"' Industrial Communications, SIMATIC NET.

c) Fiber optic cable for the redundant connection
Length: 1.6 m
Siemens order no.: 6DL9901-8AA

Interconnecting redundant IO

All analog and digital outputs of an AddFEM can be wired in parallel to outputs of the same type at another AddFEM for the redundant control of final control elements. This applies likewise to the analog voltage inputs and digital inputs.

Redundant analog current inputs, however, must be wired in series, and requires the installation of external Zener diodes (for type, see Fig. 3-12) in parallel to the inputs, in order to uphold the current flow when an AddFEM is being replaced.

Note:
Redundant AddFEM must be supplied with absolutely symmetrical IO signals.

Analog outputs

The analog outputs of redundant AddFEMs are enabled or disabled according to the module status (master or standby.)

There is no load distribution for redundant analog outputs, i.e. the load is not distributed 50 to 50 to both redundant AddFEMs.

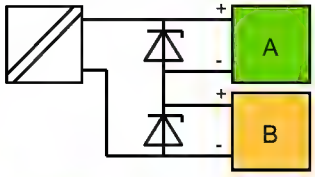
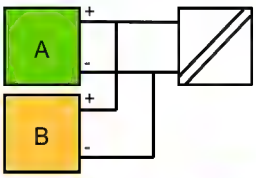
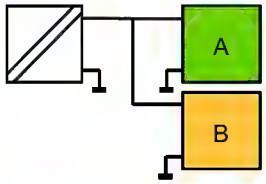
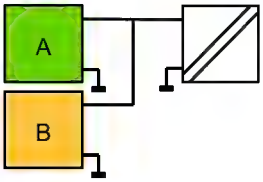
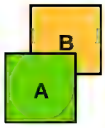
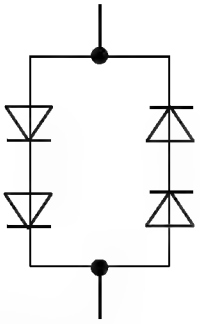
IO signal	Configuration variants
AI (analog input)	
AO (analog output)	
DI (digital input and velocity detection)	
DO (digital output)	
Legend:	**AddFEM**  **Sensor/final control element** 

Fig 5-6 Possible redundancy configurations



1.6 V bi-directional,
e.g. 4 x BZX55 COV8
for _20 mA or _30 mA

1.6 V unidirectional,
e.g. 2 x BZX55 COV8
for 0..20 mA or 4..20

Fig. 5-7 Usable diodes

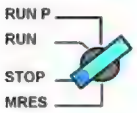
d)

5.3 Control and display elements

Control elements

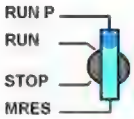
All control and display elements of the AddFEM are located on the front panel above the protective cover.
The AddFEM can be operated by means of a key switch and slide switch on the front panel. The various switch positions are described below.

Normal operation – analog outputs enabled.
In this position you can remove the key in order to prevent any unauthorized change of the operating mode.

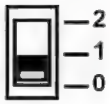


Outputs are disabled.
In redundant mode of the AddFEM, this forces a master / reserve changeover, i.e. the AddFEM is now the “reserve“ module.
You can set the PROFIBUS DP addresses and reset the AddFEM.
In this position you can remove the key in this position in order to prevent any unauthorized change of the operating mode.

Key switch position, with momentary action function.
Required for setting up the PROFIBUS DP addresses.



Reserved for function expansions.
You can not remove the key when it is in this position.



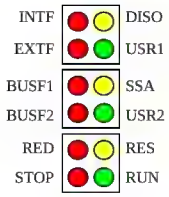
Position 0 – Spring-loaded momentary action:

The PROFIBUS DP addresses are indicated on the signal LEDs in binary code.
The display is activated for the duration of approx. three seconds.

Position 1 – latching position: home position

Position 2 – latching position: no function

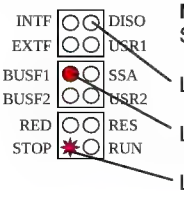
LED



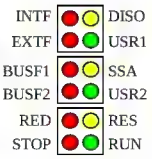
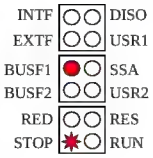
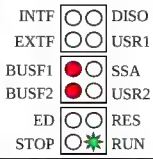
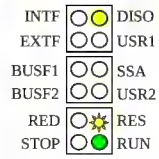
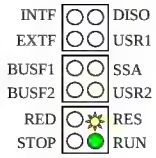
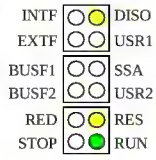
Three LED arrays above the key switch. Each with 4 LEDs for alarm (left) and status signals (right).

Operating states

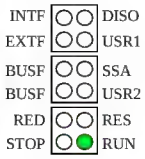
D The “POWER ON“ to “RUN ACTIVE“ operating states described below are indicated by the status and error LEDs. The states are listed in the order of the module startup sequence.



Operating states:

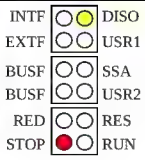
POWER ON		**LED test** After power on or reset, all error and status LEDs are switched on for the duration of approx. two seconds.
INIT		**Initialization phase** Functions executed by the AddFEM in this phase: • Setup of hardware functions • Self-test • Waitstate, approx. 4 seconds until PROFIBUS DP frames are received • Indication of the address currently set at PROFIBUS DP A (socket X3A) in binary format on the 16 signal LEDs for the digital inputs. If any fatal errors occur, the AddFEM is reset to and set to “RESET“ state
STARTUP		**Startup phase** The AddFEM locks in the startup phase if it does not receive any PROFIBUS DP frames., the reasons being: • The PROFIBUS DP master is not ready yet • The PROFIBUS DP connector is missing or defective, or not terminated yet.
CONNECT PASSIVE		**Connecting to the redundancy partner - reserve** The system synchronizes data with the redundant partner (i.e. between the redundant AddFEM and this module) via the redundant fiber optic cable connection. The module then goes into RUN PASSIVE state.
CONNECT ACTIVE		**Connecting to the redundancy partner – master** The system synchronizes data with the redundant partner (i.e. data of the redundant AddFEM and this module) via the redundant fiber optic cable connection. The module then goes into RUN ACTIVE state.
RUN-PASSIVE		**RUN state - reserve** The module is the RESERVE station and receives update data from the master module via the redundant fiber optic cable connection. The outputs are disabled, i.e. the module does not output any analog signals.

RUN-
ACTIVE



RUN state – active
The module is master and transfers update data to the reserve module via the redundant fiber optic cable connection.

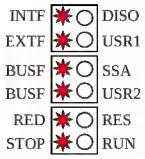
STOP



STOP state
Can only be set using the key switch. The outputs are disabled, i.e. the module does not output any analog signals.

In STOP state, you can set the bus address and reset the AddFEM using the control switches.

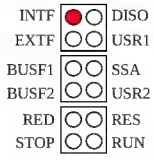
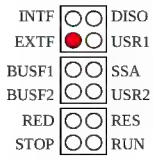
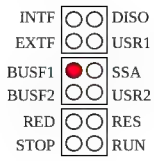
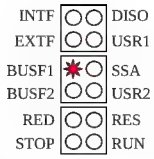
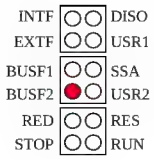
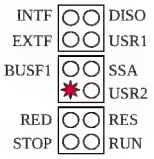
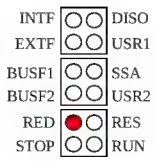
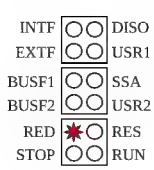
INIT



INIT state
The firmware found is incomplete and thus not executable.
The module freezes in INIT state. All red error LEDs flash.
The error may have been caused by a defective component or faulty firmware download.

To correct or avoid error:
Download the firmware again, or ship the module to Siemens for repair.

Display functions of the error and status LEDs

LED	Error class/ status	Display	Cause
INTF	Internal error		The automatic monitoring function has detected an internal error. The INTF LED is lit in case of • Memory error • Corrupted analog signal calibration data in memory.
EXTF	External error		External errors The EXTF LED is lit in case of Die LED leuchtet bei: • Faulty process signal "Analog Out" • Faulty process signal "Analog In" • Faulty process signal "Digital Out" • 24 V DC load voltage missing at digital outputs
BUSF1	Bus error 1		PROFIBUS DP interface A (X3A). The LED is statically set when ... • ...the master monitoring function has responded
			The LED flashes if configuration errors are detected, i.e. ... • ..the parameter assignment frame contains illegal parameter values. • .. the parameter values received do not match the configuration of the redundancy partner
BUSF2	Bus error 2		PROFIBUS DP interface B (X3B). The LED is statically set when ... • ...the master monitoring function has responded
			The LED flashes when configuration errors are found, i.e. ... • ..the parameter assignment frame received contains illegal parameter values. • ..the parameter values received do not match the configuration of the redundancy partner
RED	Redundancy error		Relevant only with redundant configuration of the AddFEM. The LED is lit… • ...if the fiber optic cable connection between the two redundant AddFEM modules has failed.
			The LED flashes... • if the configuration of the redundant AddFEMs is not consistent. • ...the firmware version of the master AddFEM is newer than that of the standby AddFEM

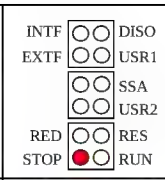
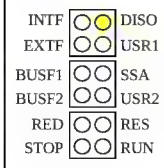
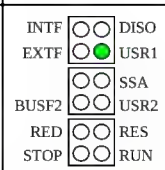
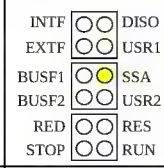
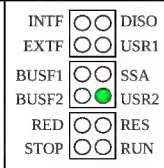
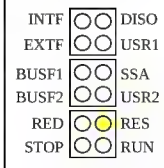
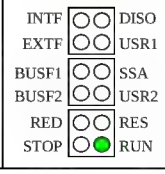
STOP	Offline (Stop)		The AddFEM is in STOP. The outputs are disabled. A master / reserve changeover of the redundant module is forced, i.e. the module is set to "forced reserve." In this state, you can also set the PROFIBUS DP addresses and reset the AddFEM.
DISO	Output disabled		All outputs are disabled for the duration of commissioning or maintenance work. The AddFEM is in STOP, or in (passive) reserve state in redundant mode.
USR1	User status 1		USER LED 1 The LED is lit when you set the PROFIBUS DP address for PROFIBUS interface A
SSA	Set Slave Address		The LED is lit when you set the PROFIBUS DP addresses
USR2	Users status 2		USER2 LED: Can be used in the signal preparation function (FEF) for specific applications.
RES	AddFEM is standby		AddFEM in standby
RUN	"Online" status		All functions can be executed

Table 5-1 Description of the error / status LEDs

Legend: ● LED is lit ✷ LED is flashing

Note
on redundant AddFEM modules. The **EXTF** LED indicates process output signal errors. The reserve module assumes the master function if a signal error is detected on the master module. You can not reset the **EXTF** signal until the module starts outputting signals, i.e. after it has assumed the master function.

5.4 Setting the PROFIBUS DP address

Each PROFIBUS DP node must be assigned a unique address which can be set in the number range "1" to "125." You can set the PROFIBUS DP address of your AddFEM using the key switch and slide switch, or in SIMATIC Manager. Both options are described below. For redundant applications it may be useful to assign the same address to both PROFIBUS DP interfaces. You may also set different addresses. Any address you assign will be written to the non-volatile memory area of AddFEM and is thus retained after power failure. When operating three to four AddFEMs on each PROFIBUS DP segment (typical configuration in turbine control systems), you should preferably assign addresses in the lower range, for example,"2", "3", "4" or "5", in order to simplify setup procedures.

5.4.1 Setting the address of PROFIBUS DP A using the key switch and slide switch

The next section describes how to set the addresses of PROFIBUS DP A and B. This setting is made with the help of the key switch and slide switch. The status LED returns the setup status. The signal LEDs temporarily indicates the set PROFIBUS DP addresses in binary format. The display is coded according to the tables below.

		PROFIBUS DP address A (X3A)						
		1	2	3	...	16	...	125
LED	1	X	-	X	...	-	...	X
„Digital	2	-	X	X	...	-	...	-
Input“	3	-	-	-	...	-	...	X
	4	-	-	-	...	-	...	X
	5	-	-	-	...	X	...	X
	6	-	-	-	...	-	...	X
	7	-	-	-	...	-	...	X
	8	-	-	-	...	-	...	X

		PROFIBUS DP address B (X3B)						
		1	2	3	...	16	...	125
LED	9	X	-	X	...	-	...	X
„Digital	10	-	X	X	...	-	...	-
Input“	11	-	-	-	...	-	...	X
	12	-	-	-	...	-	...	X
	13	-	-	-	...	X	...	X
	14	-	-	-	...	-	...	X
	15	-	-	-	...	-	...	X
	16	-	-	-	...	-	...	X

Legend: "-" = LED is dark
"X" = LED is lit or flashes

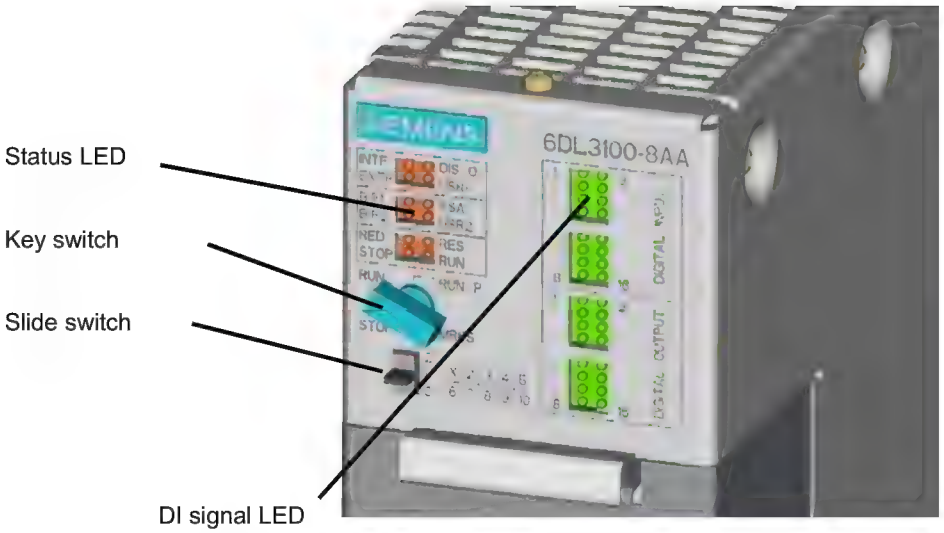
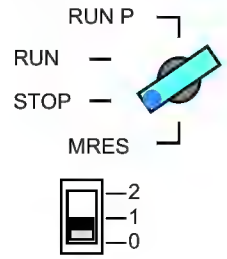
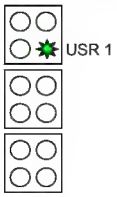
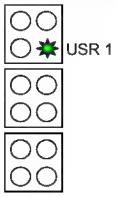
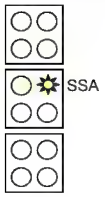
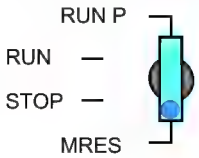
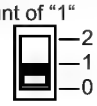


Fig. 5-8 Control elements of AddFEM and indication of the PROFIBUS DP addresses

Setting the PROFIBUS DP address for bus A using the key switch and slide switch

No.	Action	Key switch and slide switch	Display	Step sequence
1	Preparing AddFEM for setup	Turn the key switch to "STOP", set the slide switch to spring-action position 	Status LED "USR1" flashes  Status LED "USR1" flickers 	..wait until the status LED "USR1" flickers! Next, go to step 2...
2	Function mode 1: Set PROFIBUS DP address for interface A (X3A).	Release the slide switch. The slide switch returns to position 1 by spring force 	Status LED "SSA" flashes  The 16 signal LEDs for the digital inputs indicate the currently set addresses of DP A (left LEDs 1 to 8 flashing) and DP B (right LEDs 9 to 16 static) in binary representation.	Continue with step 3...
3	Confirm function mode 1	Turn the key switch to "MRES" and release it. 	Address is assigned the default value 1. Indication of the current address in accordance with row 2.	Continue with step 4...
4	Set the address	Set the relevant address in slide switch position "0". Each button action increments the address by the count of "1"  Press the slide switch longer than 3 seconds to increment the station address automatically.	Indication of the current address in accordance with row 2.	Hold the slide switch in position 0 until the address is set. Next, continue with step 5.

Continued below!

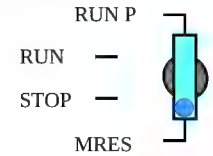
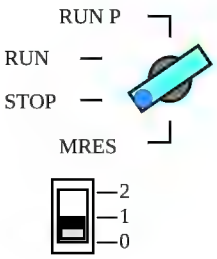
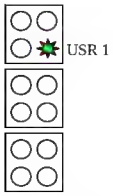
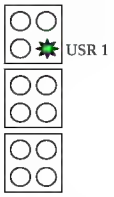
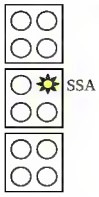
No.	Action	Key switch and slide switch	Display	Step sequence
5	Confirm the new address.	Turn the key switch to "MRES", and then release it to save the new address. 	The 16 signal LEDs for the digital inputs indicate the new address statically for the duration of approx. three seconds.	Continue with step 6.
6	Set "RUN" mode	Set the key switch to "RUN" 		Settings are completed

Table 5-2 Setting the address of PROFIBUS DP A using the key switch and slide switch

5.4.2 Setting the address of PROFIBUS DP B using the key switch and slide switch

This section offers step-by-step instructions to commissioning and maintenance personnel for setting up the address of PROFIBUS DP B (connector X3B on the AddFEM) using the AddFEM control elements (key switch and slide switch.).

Notice! The procedure described below corresponds in essence with setup procedures for PROFIBUS DP A. However, in step 2, the user needs to press the slide switch once again in its 0 position 0 to set function mode 2, “Set DP address B.“

No.	Action	Key switch and slide switch	Display	Step sequence
1	⇩ Prepare the AddFEM for setup	Turn the key switch to “STOP“, set the slide switch to spring position 0. 	Status LED “USR1“ flashes  Status LED “USR1“ flickers 	..wait until the status LED “USR1“ flickers! Continue with step 2…
2	Function mode 2: Set PROFIBUS DP address for interface B (X3B).	Release the slide switch. The slide switch returns to position 1 Press the slide switch once again in position 0 to set function mode 2!   Release the slide switch!	Status LED "SSA" flashes  The 16 signal LEDs for the digital inputs indicate the currently set addresses for DP A (left LEDs 1 to 8 static) and DP B (right LEDs 9 to 16 flashing) in binary representation.	Continue with step 3...

Continued below!

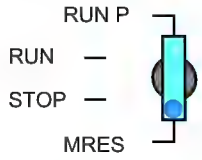
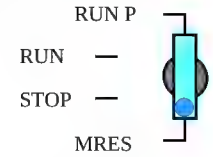
No.	Action	Key switch and slide switch	Display	Step sequence
3	Confirm function mode 2	Turn the key switch to "MRES" and release it. 	Indication of the current address in accordance with row 2.	Continue with step 4...
4	Set the address	Set the relevant address in slide switch position "0". Each button action increments the address by the count of "1"  Press the slide switch longer than 3 seconds to increment the station address automatically.	Indication of the current address in accordance with row 2.	Hold the slide switch in position 0 until the address is set. Next, continue with step 5
5	Confirm the new address.	Turn the key switch to "MRES", and then release it to save the new address. 	The 16 signal LEDs for the digital inputs indicate the new address statically for the duration of approx. three seconds.	Continue with step 6.
6	Set "RUN" mode	Set the key switch to "RUN" 		Settings are completed

Table 5-3 Setting the address of PROFIBUS DP B using the key switch and slide switch

5.4.3 Verifying the PROFIBUS DP address setting

You can verify your settings of the PROFIBUS DP addresses in online mode. For procedures at the AddFEM, see the table below.

No.	Action	Key switch and slide switch	Display	Step sequence
1	View PROFIBUS DP addresses	Key switch in "RUN" or "RUN P" position  Operate the slide switch in position 0 and then release it.  	The 16 signal LEDs for the digital inputs indicate the new address statically for the duration of approx. three seconds	Settings are completed

Table 5-4 Verifying the PROFIBUS DP address settings

5.4.4 Resetting the AddFEM

Procedure for resetting the AddFEM:

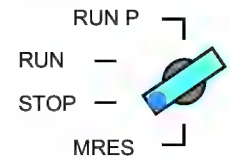
No.	Action	Key switch and slide switch	Display	Step sequence
1	Reset the AddFEM	Key switch to STOP" position  Hold the slide switch in 0 position for **at least 10 seconds,** then release it.  	The ADDFEM will be reset on expiration of a delay time of approx. 10 s. After restart, all status LEDs will be switched on for the duration of approx. 1 s.	Settings are completed

Table 5-5 Resetting the AddFEM

5.4.5 Setting the PROFIBUS DP address in SIMATIC Manager

You may also use a SIMATIC programming device (PG) in preference of the key and slide switches described earlier to set the PROFIBUS DP addresses. The SSA frame (SSA : SET SLAVE ADDRESS) containing the new PROFIBUS DP address is here transferred to the AddFEM via PROFIBUS DP. Having received this frame, the AddFEM automatically saves the new address to its non-volatile memory area for reuse. This setting is made separately for PROFIBUS DP A and PROFIBUS DP B.

To set the PROFIBUS DP address, connect the PG (PG 740, PG 760 etc.) to the AddFEM by connecting an MPI patch cable to PROFIBUS DP interface X3A or X3B.

Run SIMATIC Manager, then select "PLC" -> "Assign PROFIBUS Address" to immediately assign a new address. The dialog box also indicates the old, current address.

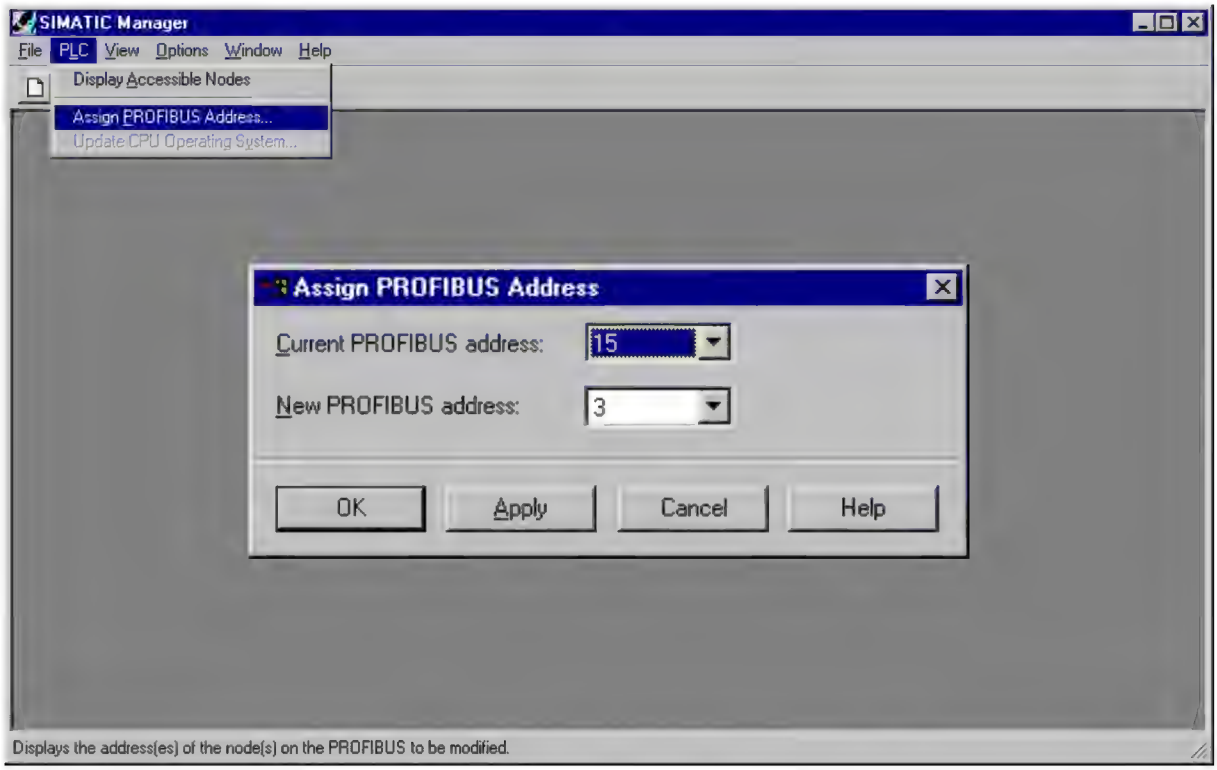


Fig. 5-9 Assigning the PROFIBUS DP address in SIMATIC Manager

5.5 Configuring the AddFEM

The AddFEM is configured via PROFIBUS DP according to procedures defined in the PROFIBUS standard.
The CD supplied with your AddFEM contains a GSD file you can edit using the usual PROFIBUS configuration tools, such as HW Config or COM-PROFIBUS. Based on this file, the configuration tool generates a master parameter data set. This set will be saved to memory in the automation processor (AP), and downloaded to the AddFEM within the initialization phase.
For further information, refer to the description of the configuration tool used.

For further information on using the GSD files, refer to "readme.pdf" on the AddFEM CD.

5.5.1 Adjustable parameters

Parameter	Range / Value	Remarks
Operating mode AddFEM	"Standard not redundant" "AS red. Add FEM not red." "AS not red. Add FEM red." "AS red. Add FEM red."	Mode 0 Mode 1 Mode 2 Mode 3 (see also chapter 3.3 "Modes of operation")
Redundant AddFEM	"No redundant partner" "PROFIBUS-Address: 1" … "PROFIBUS-Address: 125"	This Parameter is available only with "SIMATIC PCS7" configuration. Default setting is "No redundant partner"
Input type/range AI 1 … Input type/range AI 6	"Current 4...20 mA" "Current 0...20 mA" "Current +/- 20 mA" "Current +/- 30 mA" "Voltage +/- 10 V" "Voltage 0...10 V"	The analog inputs 1 to 12 support channel-selective adjustments. The analog inputs 1 to 6 can be programmed for operation as voltage or current input mode.
Input type/range AI 7 … Input type/range AI 12	"Current 4...20 mA" "Current 0...20 mA" "Current +/- 20 mA" "Current +/- 30 mA"	Analog inputs 7 to 12 can only be used in current input mode.
Output type/range AO 1 … Output type/range AO 8	"Current 4...20 mA" "Current 0...20 mA" "Current +/- 20 mA" "Current +/- 30 mA" "Current +/- 50 mA"	The analog outputs 1 to 8 support channel-selective adjustments, are implemented for operation in current output mode, and can be programmed for output in the ± 30 mA range. Note: the analog outputs 1 to 4 may also be programmed for short-term loads of up to ± 50 mA. The analog outputs 5 to 8 can be programmed for operation at max. ± 30 mA.
Counter 1	"Ident. of rot. direction off" "Ident. of rot. direction on"	Counter 1 can be programmed for operation with or without detection of the rotational direction. If detection of the rotational direction is enabled, channel 1 returns the leading, and channel 2 the lagging signal
Filter AI 1 … Filter AI 12	"No filter" "Filter 50 Hz" "Filter 60 Hz" "Filter 16 2/3 Hz"	A filter function can be programmed for each analog input to suppress the relevant mains frequency. The system provides 50 Hz, 60 Hz and 16 2/3 Hz filters which can be set individually for each analog input (channel-selective.) Default setting is "No filter", i.e. disabled!
Delayed shutoff	"0 ms" "10 ms" "20 ms" "50 ms" "100 ms" "200 ms" "500 ms" (default) "1 s" "2 s" "3 s"	The AddFEM is capable of compensating short-term gaps in the execution cycle of the automation processor, for example, when the system updates redundant APs. A "hard" shutoff of the outputs is not carried out unless the set tolerance time has expired.

Table 5-6 Adjustable parameters

5.5.2 Integration in automation systems

Siemens provides drivers and / or configurations for the integration of AddFEM in various host systems. Those drivers support the easy integration of AddFEM in different system environments. A description of this integration and of its configuration is available in the manuals and documentation of the relevant systems.

5.5.2.1 Overview of automation systems

System	CPU/PROFIBUS interface	AddFEM type	GSD	Comment
SIMADYN D TXP AS 620 T	PM6 (PM5) with CS7 communications module, and SS52 communications module for the PROFIBUS DP interface	6DL3100-8AA	Si0180A3.GS?	**GSD model name:** **Add FEM, Type -8AA** Basic functionality (only IO)
		6DL3100-8AB	Si0280A3.GS?	**GSD model name:** **Add FEM, Type -8AB** Not for new projects!
SIMATIC PCS7 S7-400/FM458 TXP AS 620T	S7 400/FM458 EXM448 expansion module for the PROFIBUS DP - interface	6DL3100-8AA	Si0180A3.GS?	**GSD model name:** **Add FEM, Type -8AA** Basic functionality (IO) + redundancy changeover of AddFEM with fiber optic connection
		6DL3100-8AB	Si0280A3.GS?	**GSD model name:** **Add FEM, Type -8AB** Not for new projects!
		6DL3100-8AC	SiF080A3.GS?	**GSD model name: AddFEM/FM458** • Suitable for integration in the DP interface of FM458 • Diagnostics interrupts are not supported • Basic functionality (IO) + redundancy changeover of AddFEM with fiber optic connection Front-End-Function: not configurable
SIMATIC PCS7 S7-400/FM458 TXP AS 620T	S7 400/FM458-1_DP with internal on-board PROFIBUS interface, with external EXM448 expansion module	6DL3100-8AC	SiF080A3.GS?	**GSD model name: AddFEM/FM458** • Suitable for integration in the DP interface of FM458 • Diagnostics interrupts are not supported • Basic functionality (IO) + redundancy changeover of AddFEM with fiber optic connection Front-End-Function: not configurable
TXP AS 620 B	SIMATIC S5 155H/ AS 620 B with PROFIBUS communications module	6DL3100-8AC	SiT080A3.GS?	**GSD model name: AddFEM/TXP S5** • Suitable for integration in TXP S5 with IM308-C • Diagnostics interrupts are not supported Front-End-Function: not configurable
SPPA-T3000	S7 400/FM458-1_DP with internal on-board PROFIBUS interface, with external EXM448 expansion module S7-400 with PROFIBUS communications module CP443-5	6DL3100-8AC	SiT680A3.GS?	**GSD model name: AddFEM/SPPA-T3000** • Suitable for hardware proxies on the SPPA-T3000 system • Configuration of AddFEM in HW Config as "redundant standard slave" (automatic integration in redundant bus systems) is supported • Diagnostics interrupts are not supported • No editable parameters – parameters are always assigned in acyclic DP-V1 jobs Front-End-Function: configurable PoCo and SoE
SIMATIC PCS7	S7 400 with PROFIBUS communications module CP443-5	6DL3100-8AC	Si0580A3.GS?	**GSD model name: AddFEM/PCS7/PARAM** • Suitable for PCS7 channel drivers • Configuration of AddFEM in HW Config as "redundant standard slave" (automatic integration in redundant bus systems) is supported • Diagnostics interrupts are not supported • Front-End-Function: configurable PoCo and SoE

Table 5-7 Overview of automation systems

5.5.2.2 Integration in SIMATIC PCS7

For information on the integration of AddFEM in SIMATIC PCS7, refer to:

Manual

AddFEM
Getting Started – First steps in commissioning

This manual is included on your AddFEM CD

5.5.2.3 Integration in SPPA-T3000

For information on the integration of AddFEM in SPPA-T3000, refer to the Online documentation of the system.

5.5.2.4 Integration in TELEPERM XP

For information on the integration of AddFEM in TXP, refer to this TXP documentation:

Manual

TELEPERM XP
Automation system AS 620
Field bus

Order no.: 6DQ6250-1HE01
Release 7.7

Chapter 15 of this manual contains the operating instructions

Flexible Field device integration in TXP:
MICROMASTER 411, SIMEAS P, SIPART DR19, SIMATIC S7-315F, AddFEM

5.6 Troubleshooting

5.6.1 Hot-swapping faulty redundant AddFEMs

The decisive factor in ensuring uninterrupted operation of the AddFEM modules is their hot-swap capability.

Initial situation

Failure	Reaction of the AddFEM modules
An AddFEM fails	The partner module assumes the master function

Replacement requirements

The replacement procedure described below is only below is only possible if the "new" AddFEM

- is of the same version as the failed, and if
- any existing signal preparation functions (FEF) have the same firmware version.

Procedure

Step	What to do	Reaction of the AddFEM
1	Turn the key switch on the relevant module from RUN to STOP position	The partner module assumes the master function and changes to CONNECT_ACTIVE mode. (RES LED flashes)
2	Remove the fiber optic cable of the redundant connection	Both AddFEM modules signal an error in the redundant connection (RES LED is lit).
3	Disconnect the power supply	
4	Disconnect the process signal cables, then remove the module	
5	• Install the new module • Connect the process signal cables • Connect the fiber optic cable of the redundant connection • Turn the key switch to STOP position • Connect the power supply	
6	Turn the key switch from STOP to RUN	The AddFEM modules automatically run the CONNECT routine. The new module assumes the reserve function

1)

Note

If a redundant fiber optic connection is faulty or missing, the AP determines the master / reserve assignment based on the current error rating.

2)

Caution

When the system is in operation, always set the key switch to STOP position before you connect the redundant fiber optic cable to the standby module. After it is connected, you can reset the switch to RUN.

If this is ignored, the insertion may lead to several unwanted master / reserve changeovers if the error rating at both modules is not balanced, for example, as a result of external disturbance of the process signals connected to the redundant modules.

Front connectors, pin assignment

A

Overview

The tables below show the pin assignments of connectors X4 to X7.

Connector X4

Pin no.	Name	Function	Pin no.	Name	Function
1	NC	n.c.	11	NC	nicht belegt
2	S1+	Analog output channel 1	12	M1+	Analog input channel 1+
3	S2+	Analog output channel 2	13	M1-	Analog input channel 1-
4	S3+	Analog output channel 3	14	M2+	Analog input channel 2+
5	S4+	Analog output channel 4	15	M2-	Analog input channel 2-
6	S5+	Analog output channel 5	16	M3+	Analog input channel 3+
7	S6+	Analog output channel 6	17	M3-	Analog input channel 3-
8	S7+	Analog output channel 7	18	M4+	Analog input channel 4+
9	S8+	Analog output channel 8	19	M4-	Analog input channel 4-
10	M	Reference potential AO / AI	20	M	Reference potential AI

Connector X5

Pin no.	Name	Function	Pin no.	Name	Function
1	NC	n.c.	11	NC	nicht belegt
2	M5+	Analog input channel 5+	12	M9+	Analog input channel 9+
3	M5-	Analog input channel 5-	13	M9-	Analog input channel 9-
4	M6+	Analog input channel 6+	14	M10+	Analog input channel 10+
5	M6-	Analog input channel 6-	15	M10-	Analog input channel 10-
6	M7+	Analog input channel 7+	16	M11+	Analog input channel 11+
7	M7-	Analog input channel 7-	17	M11-	Analog input channel 11-
8	M8+	Analog input channel 8+	18	M12+	Analog input channel 12+
9	M8-	Analog input channel 8-	19	M12-	Analog input channel 12-
10	M	Reference potential AI	20	M	Reference potential AI

Connector X6

Pin no.	Name	Function	Pin no.	Name	Function
1	1N	Reference potential channels 1, 2, 3	11	3N	Reference potential channels 9, 10, 11, 12
2	1	Counter/digital input channel 1	12	9	Digital input channel 9
3	2	Counter/digital input channel 2	13	10	Digital input channel 10
4	3	Counter/digital input channel 3	14	11	Digital input channel 11
5	NC	n.c.	15	12	Digital input channel 12
6	5	Digital input channel 5	16	13	Digital input channel 13
7	6	Digital input channel 6	17	14	Digital input channel 14
8	7	Digital input channel 7	18	15	Digital input channel 15
9	8	Digital input channel 8	19	16	Digital input channel 16
10	2N	Reference potential channels 5, 6, 7, 8	20	4N	Reference potential channels 13, 14, 15, 16

Connector X7

Pin no.	Name	Function	Pin no.	Name	Function
1	1L+	Power supply L+ channels 1 to 8	11	2L+	Power supply L+ channels 9 to 16
2	1	Digital output channel 1	12	9	Digital output channel 9
3	2	Digital output channel 2	13	10	Digital output channel 10
4	3	Digital output channel 3	14	11	Digital output channel 11
5	4	Digital output channel 4	15	12	Digital output channel 12
6	5	Digital output channel 5	16	13	Digital output channel 13
7	6	Digital output channel 6	17	14	Digital output channel 14
8	7	Digital output channel 7	18	15	Digital output channel 15
9	8	Digital output channel 8	19	16	Digital output channel 16
10	1M	Reference potential channels 1 to 8	20	2M	Reference potential channels 9 to 16